ELECTRICAL REVIEW 31 JANUARY 1958

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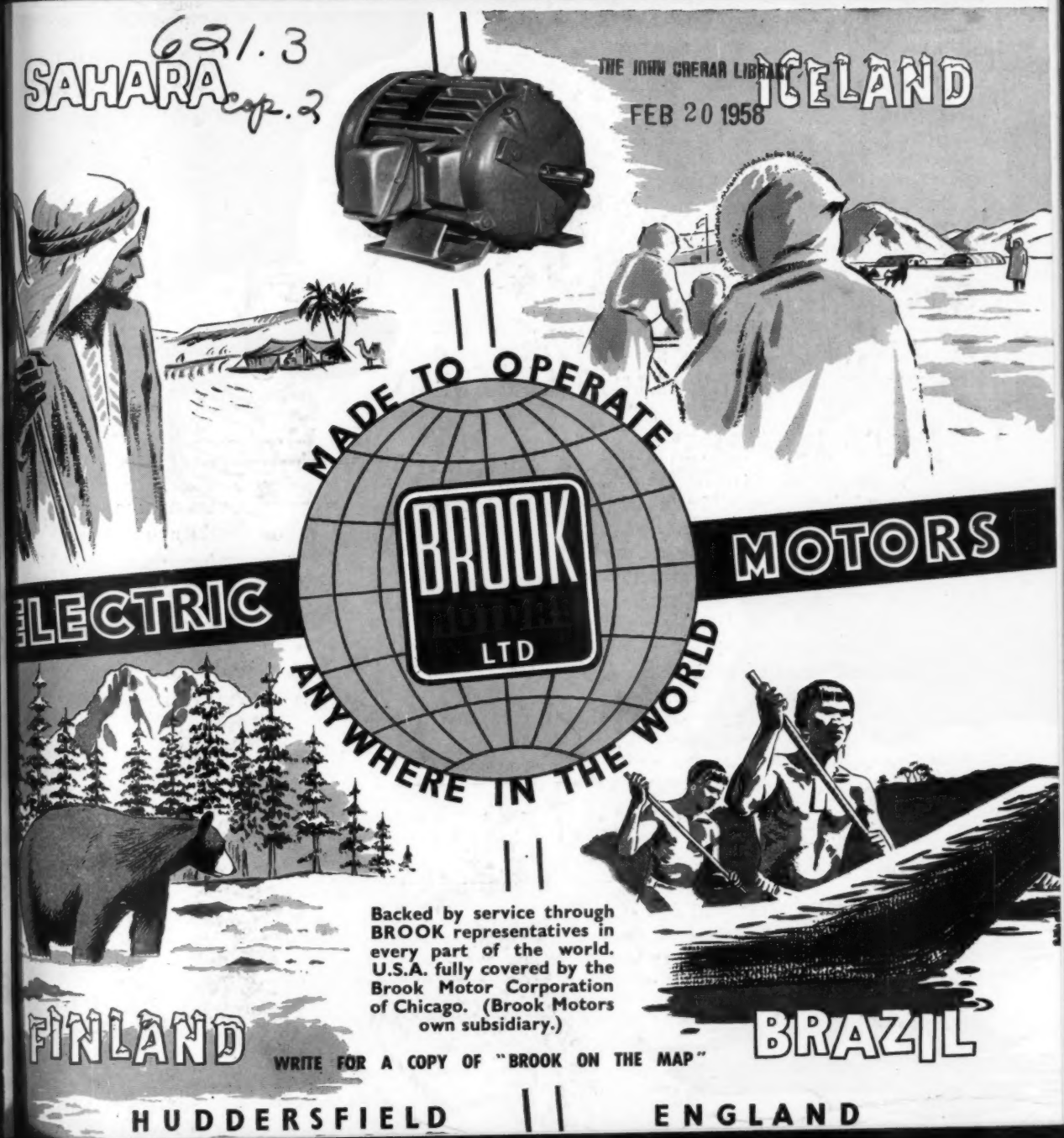

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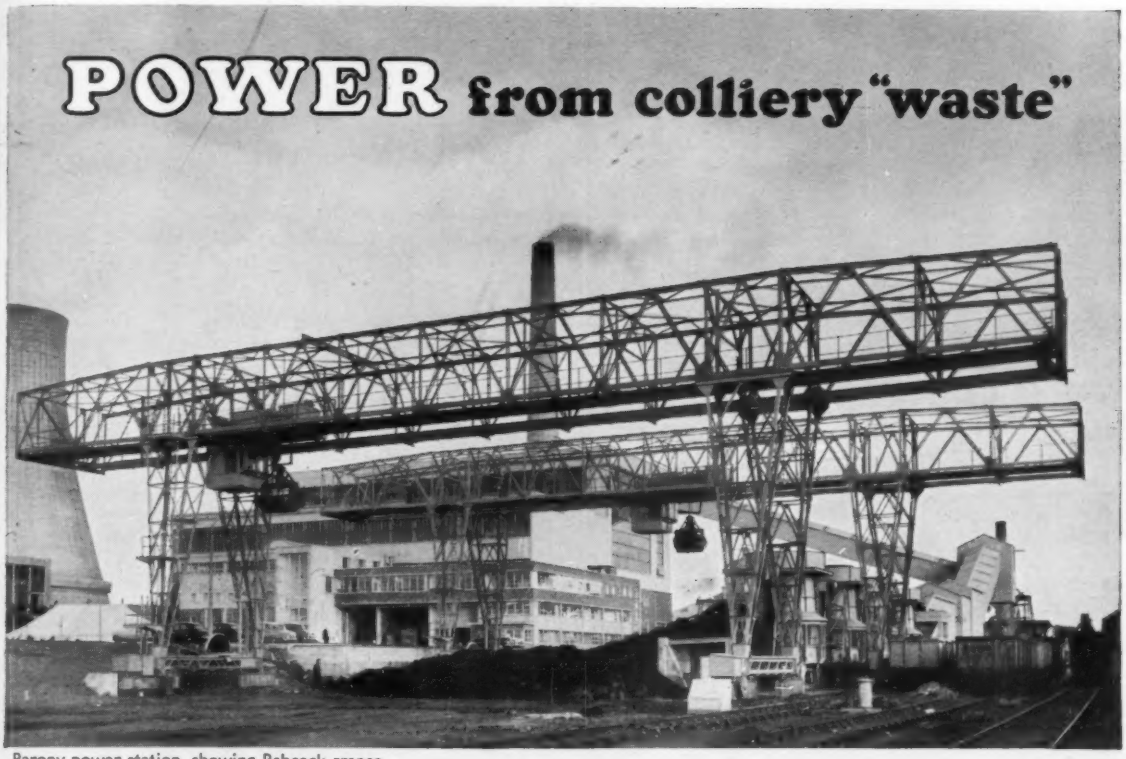
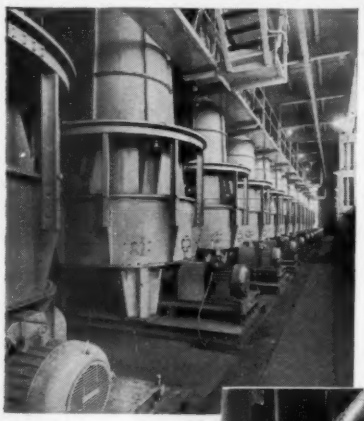


Barony power station, showing Babcock cranes, rotary hoppers and fuel conveyor system.

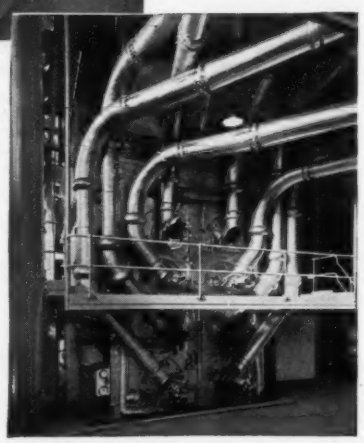


Line of Babcock rotary hoppers for handling slurry to the drying and pulverizing mills feeding the boilers.

The whole of the boiler plant for the new Barony power station (South of Scotland Electricity Board), comprising four 150,000 lb./hr. pulverized-coal-fired boilers, and the whole of the coal and ash handling equipment, are of BABCOCK design and manufacture.

Outstanding feature of this installation is its ability to use as fuel, "washery-slurry"— a wet, putty-like and previously unusable by-product of the coal-washing plants.

This has been made possible through the development by Babcock & Wilcox of new, economic methods and equipment for the handling and preparation of "washery-slurry" for use as a boiler fuel — one of many BABCOCK contributions to national fuel economy.



P.F. burners and fuel piping on one of the boilers.

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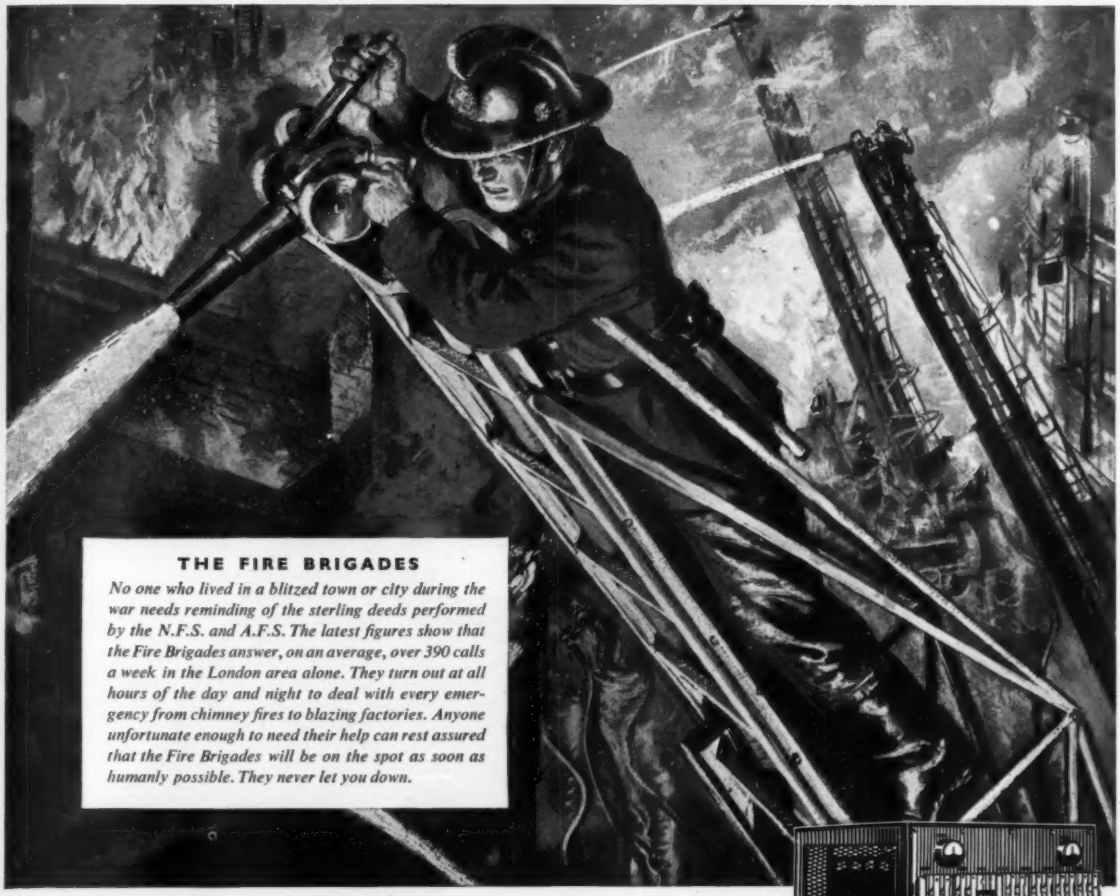

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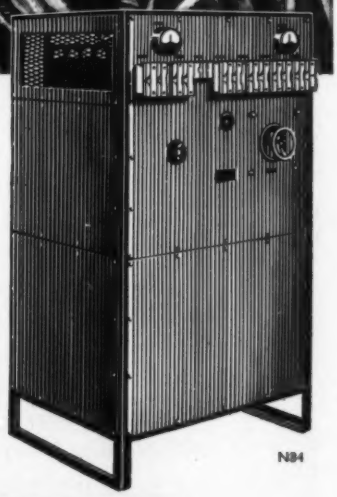

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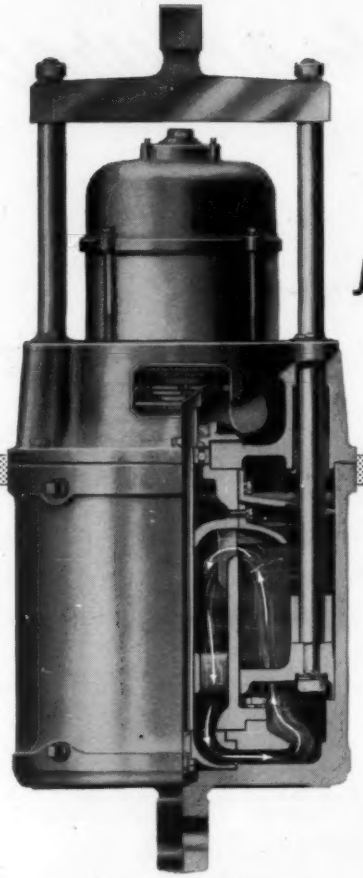

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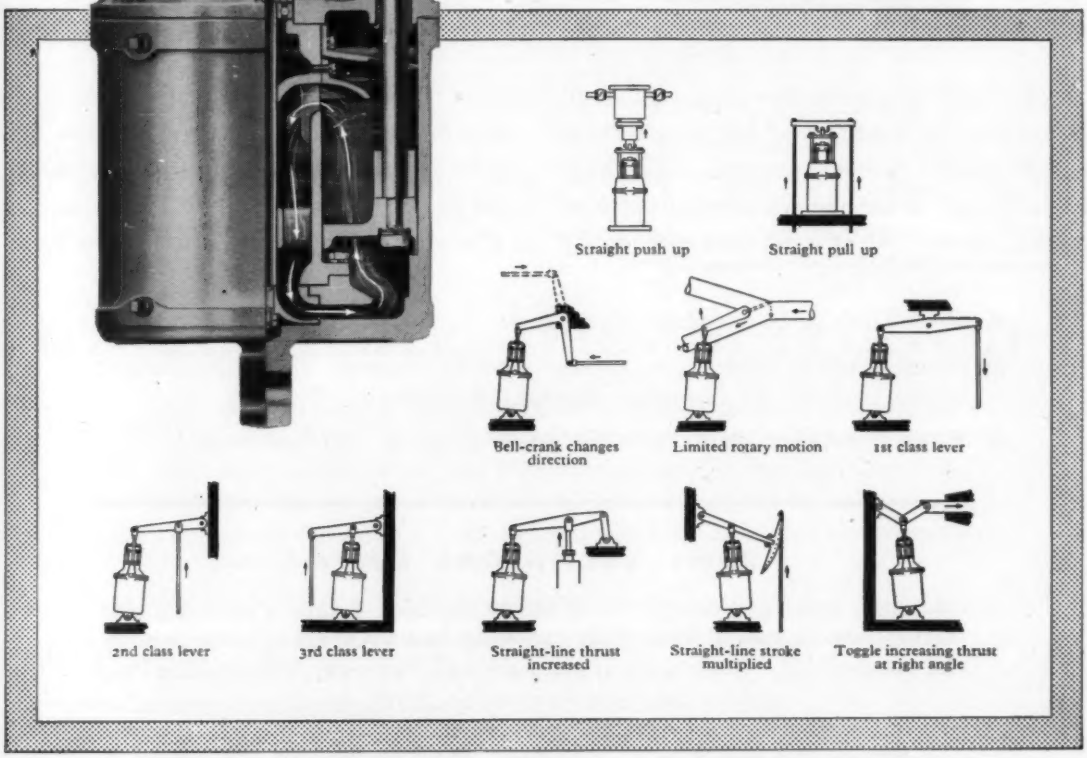

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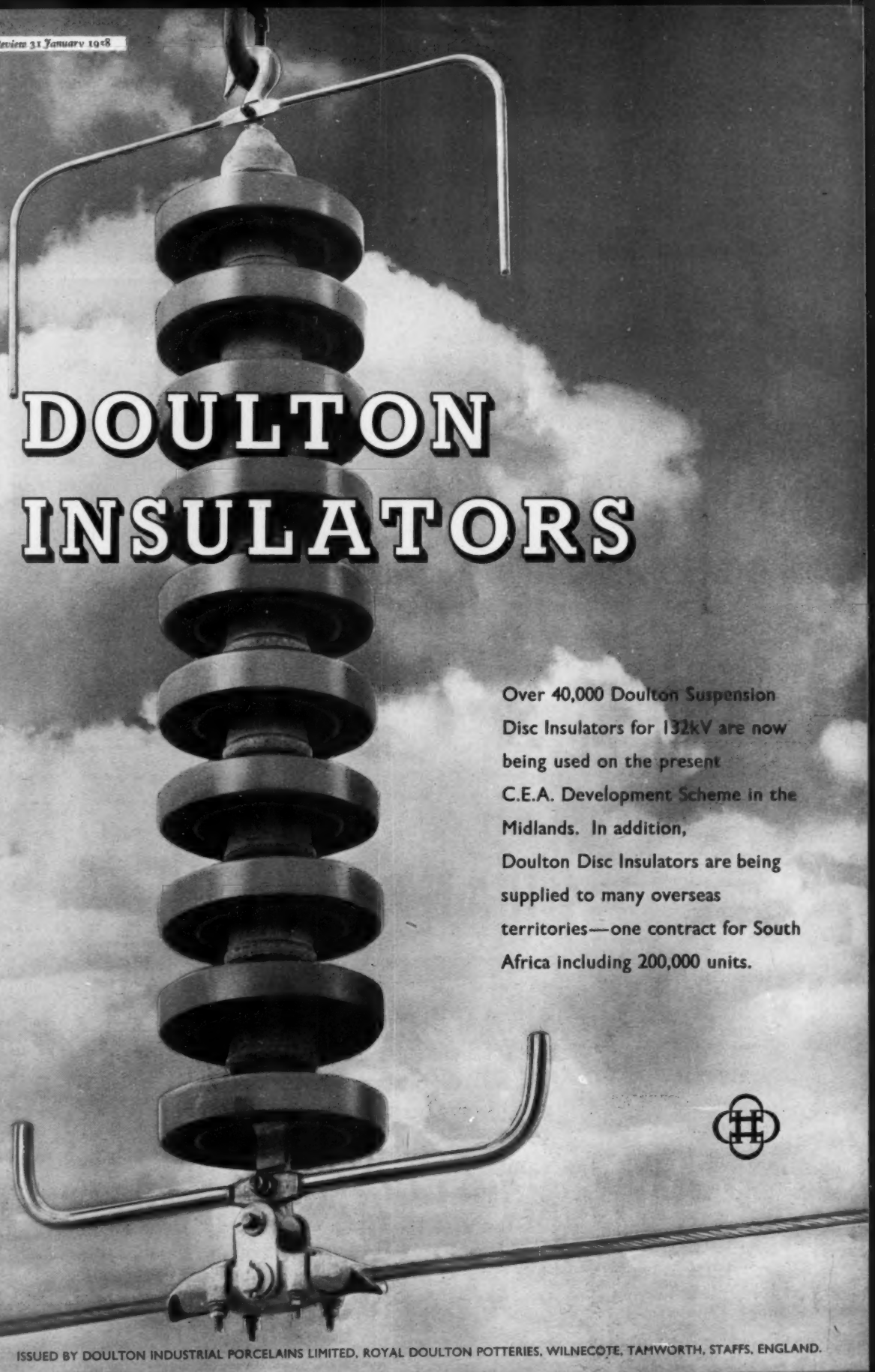

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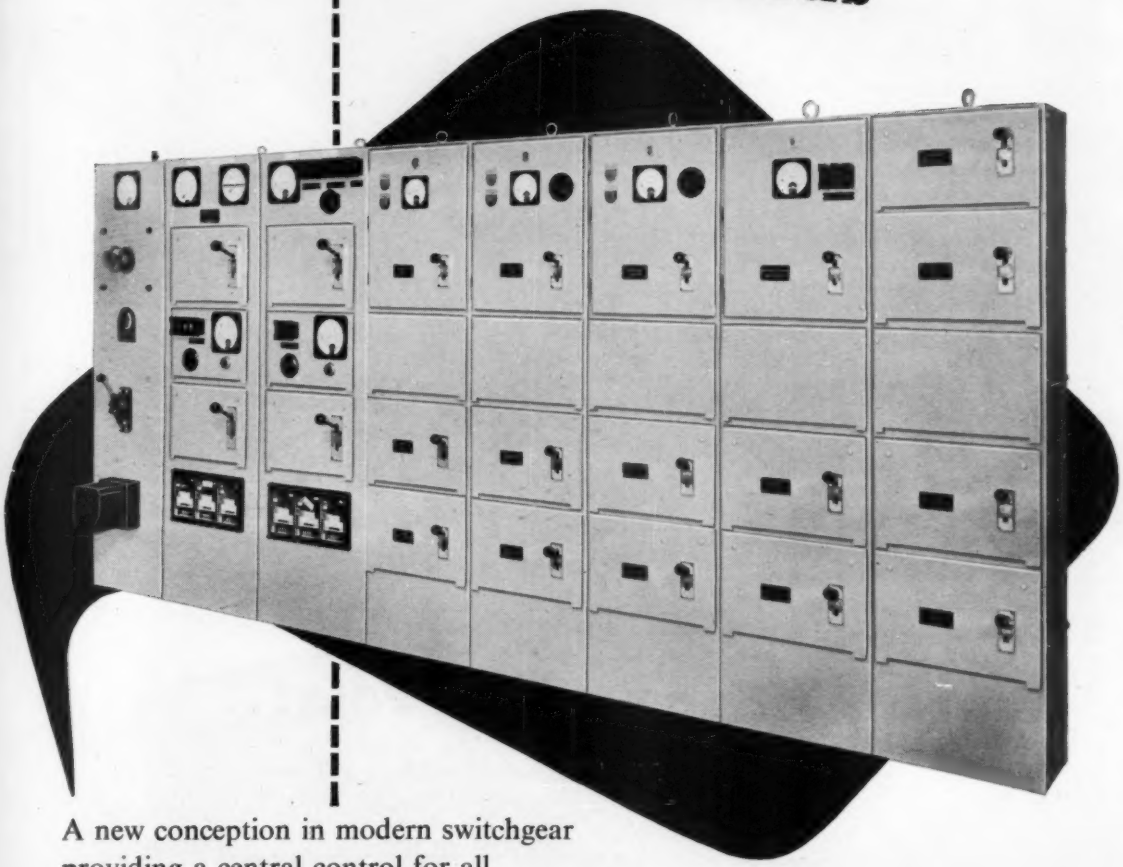

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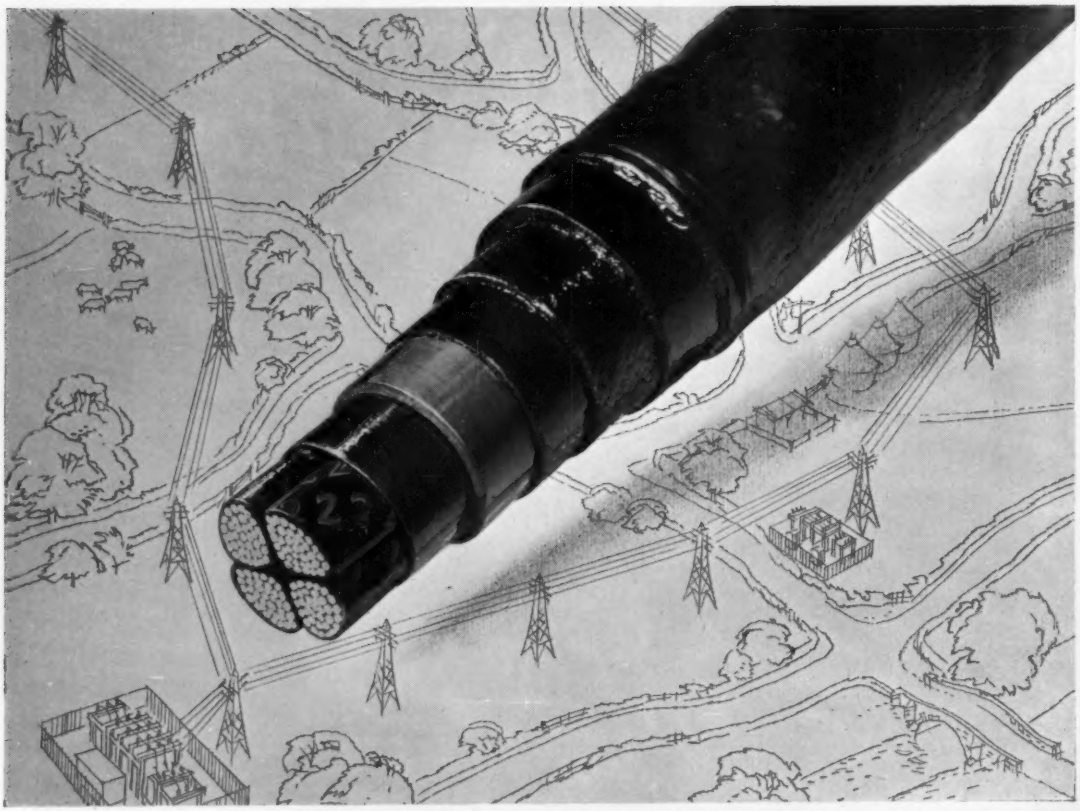

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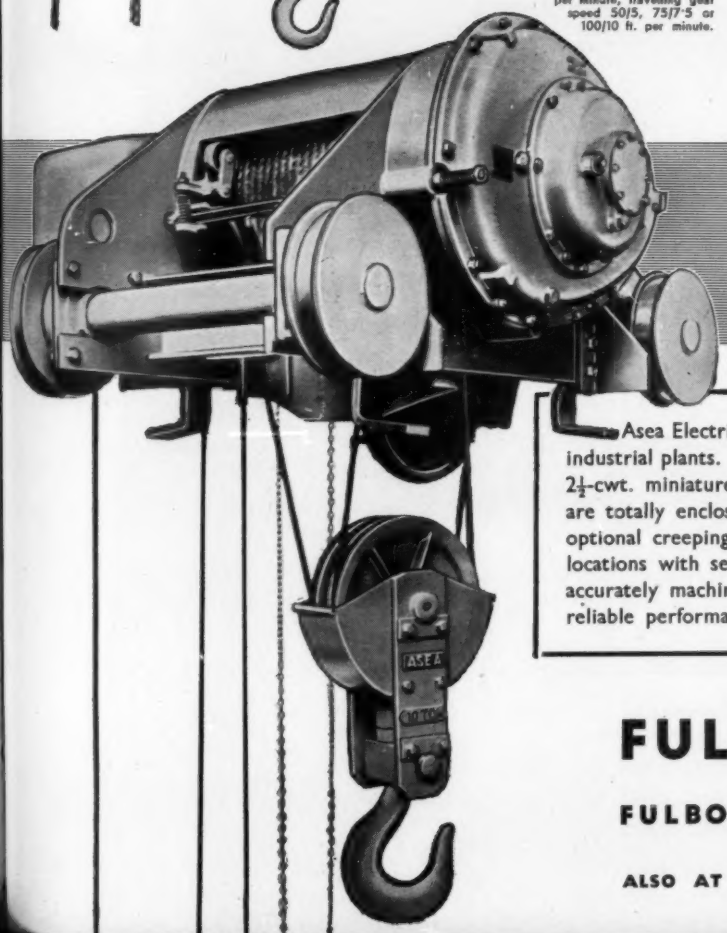

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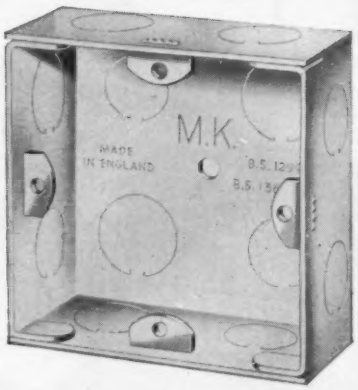

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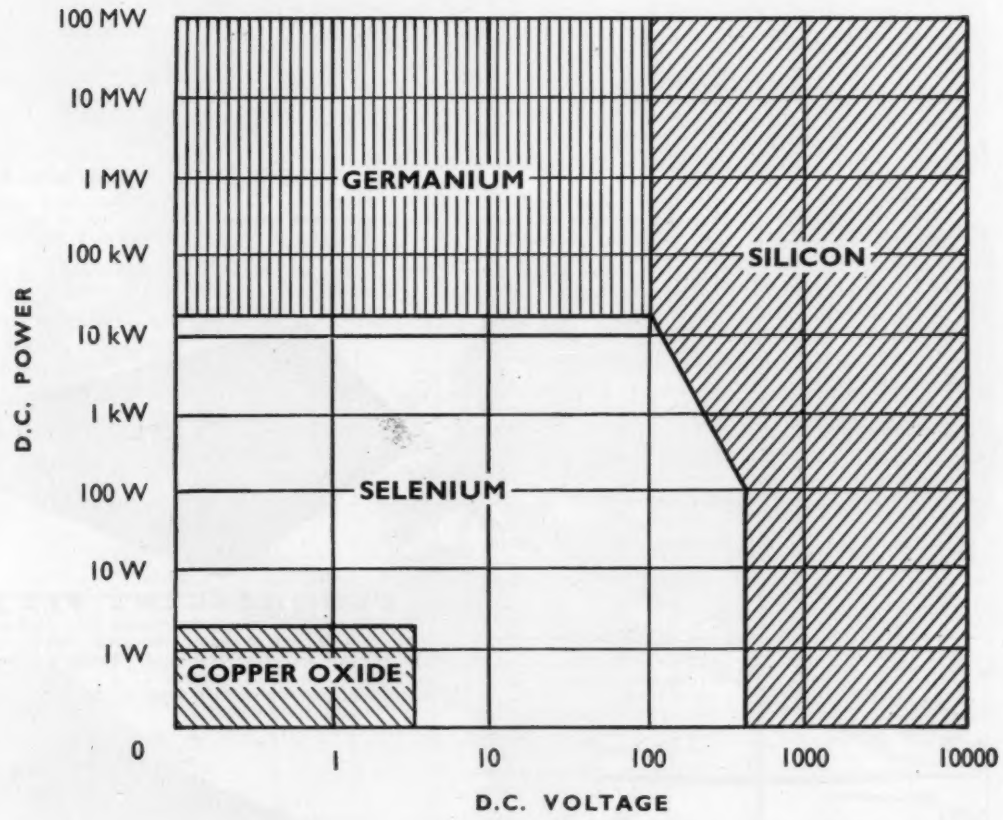

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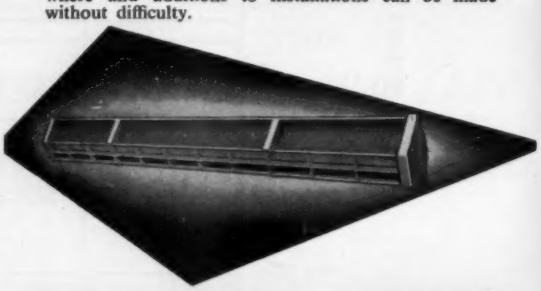

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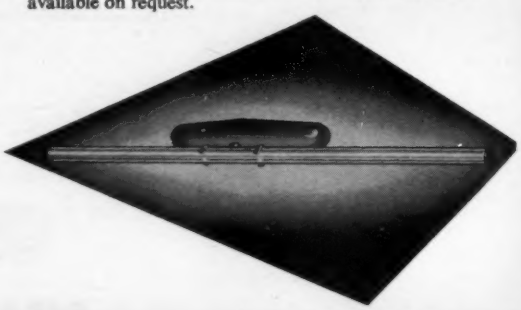

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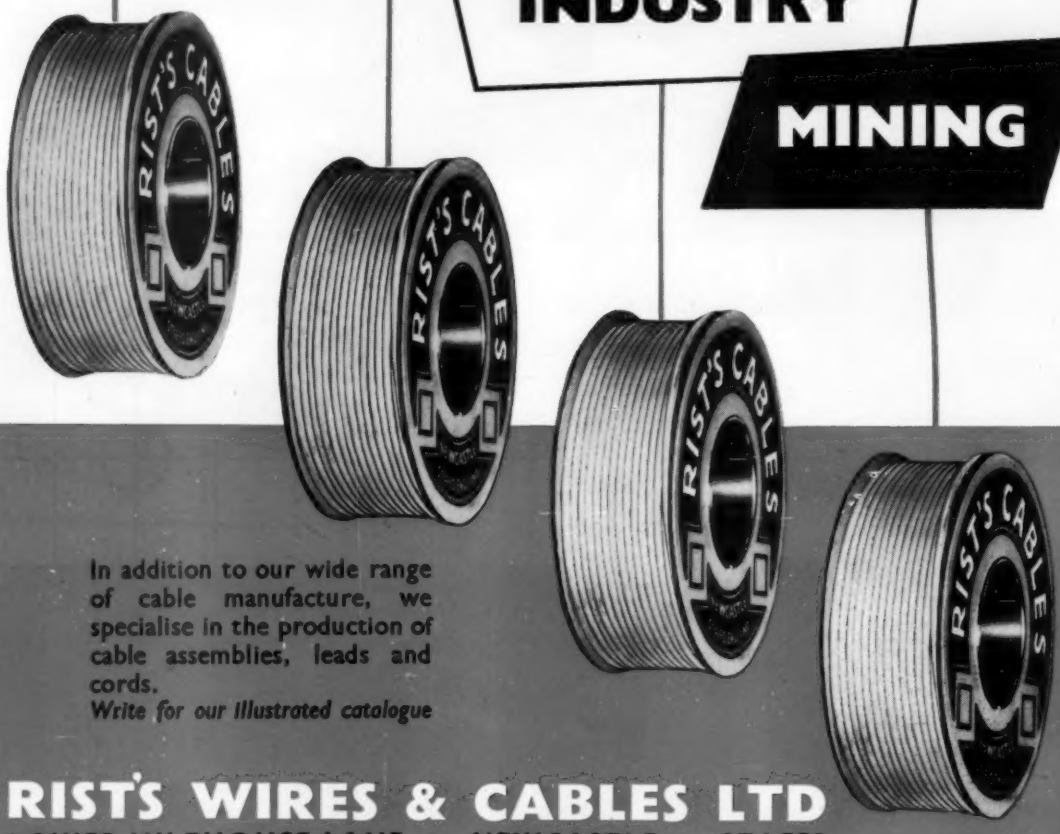

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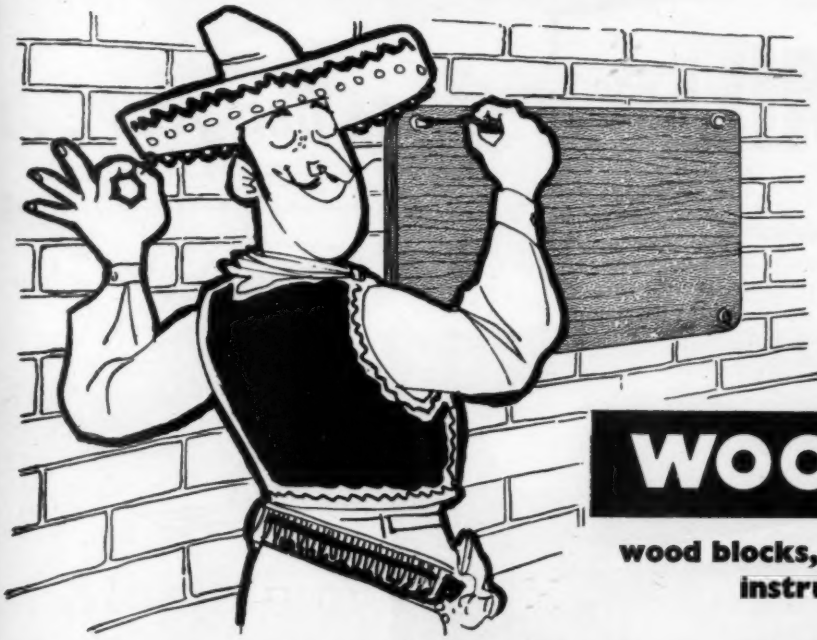

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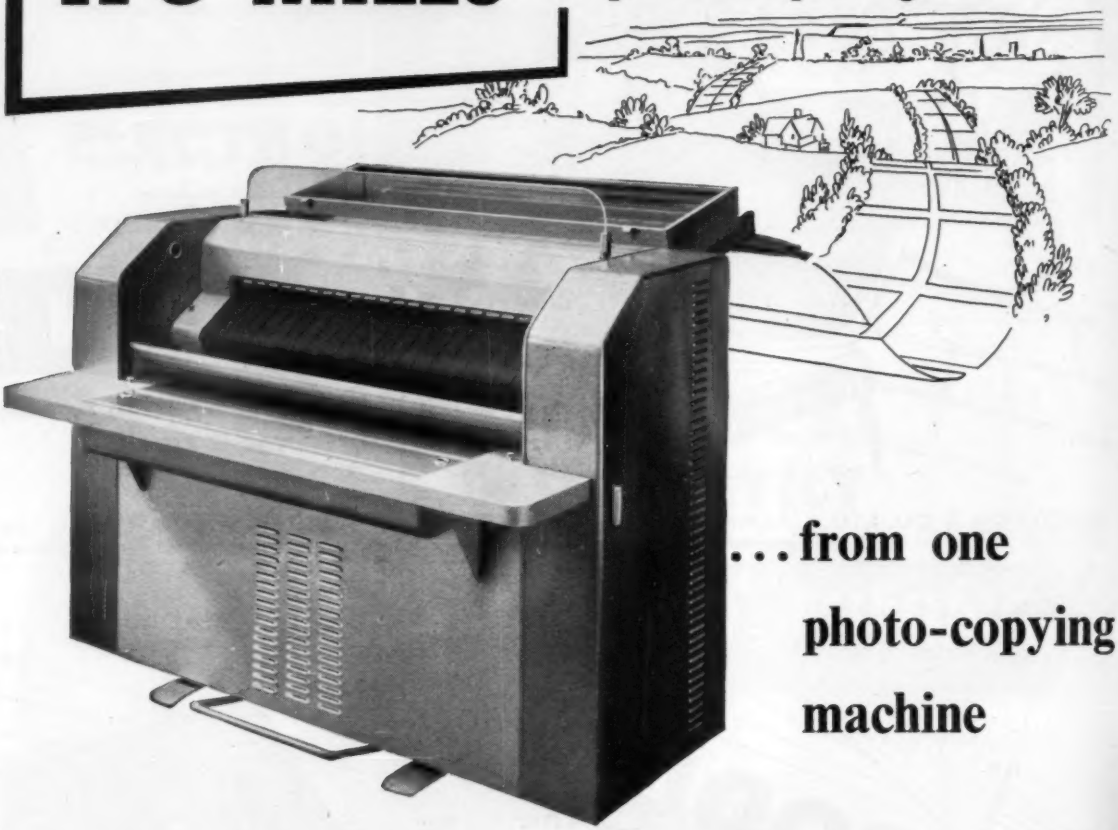

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AZOFLEX MODEL 46/35 combined synchronised printer and developer. Capacity : cut sheets and rolls up to 42 in. wide. Printing speed: up to 30 ft. per minute. Dimensions : Height 58 in. Depth 60 in. Width 72 in. Weight 1,100 lb. Price £1,555 (including delivery and installation in the U.K.).

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Enquiries to : Ilford Limited, Azoflex Dept. AZ11F
104 High Holborn, London, W.C.1. Telephone : HOLborn 3401

PHOTO-PRINTING MACHINES AND MATERIALS

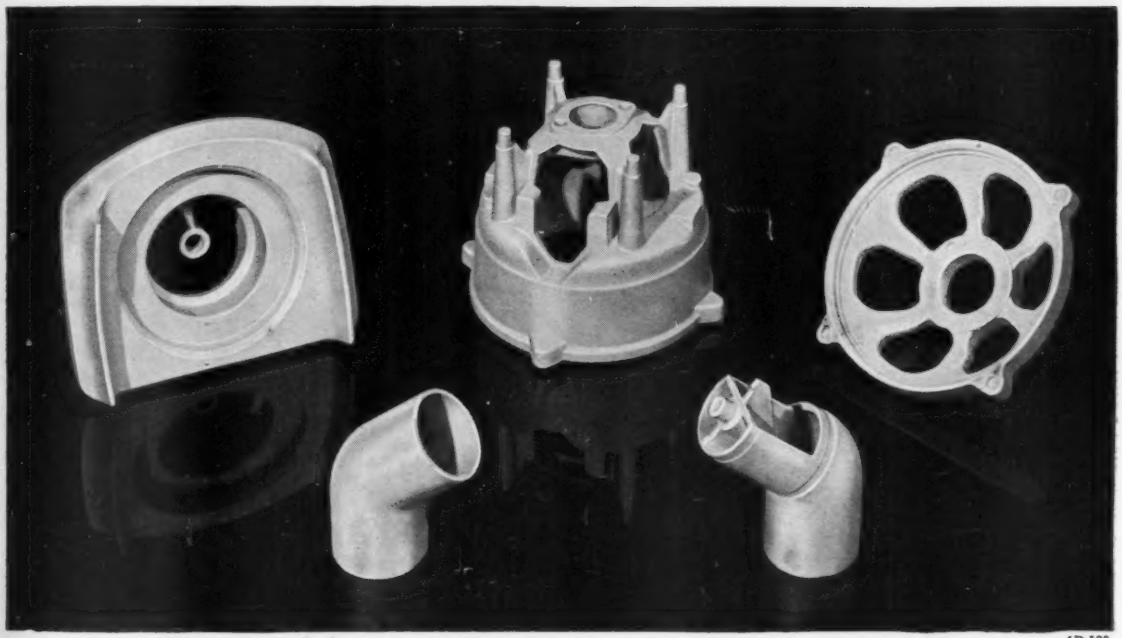
Electrolux cylinder type Suction Cleaner model 62 and accessories.

Aluminium Alloy Castings

by William Mills Limited

FRIAR PARK FOUNDRY · FRIAR PARK ROAD · WEDNESBURY · STAFFS.

Photographs by courtesy of Electrolux Ltd., London, W.1.



AP-123

Flawless

No, we shall not be silly and claim that our castings are as flawless as a piece of 16th century Venetian Glass. But we can go this far: we can say that just as the old master craftsmen got great satisfaction out of doing a job as well as it could possibly be done, so do we. That is why so many customers whose castings must have a fine skin which will readily anodise put their trust in Great Bridge Foundries

PRECISION CASTINGS IN ALUMINIUM, GUN METAL, GREY IRON, ETC. TO ALL SPECIFICATIONS

Phos. bronze and gun metal solid and cored sticks always in stock

THE GREAT BRIDGE FOUNDRY CO. LTD.

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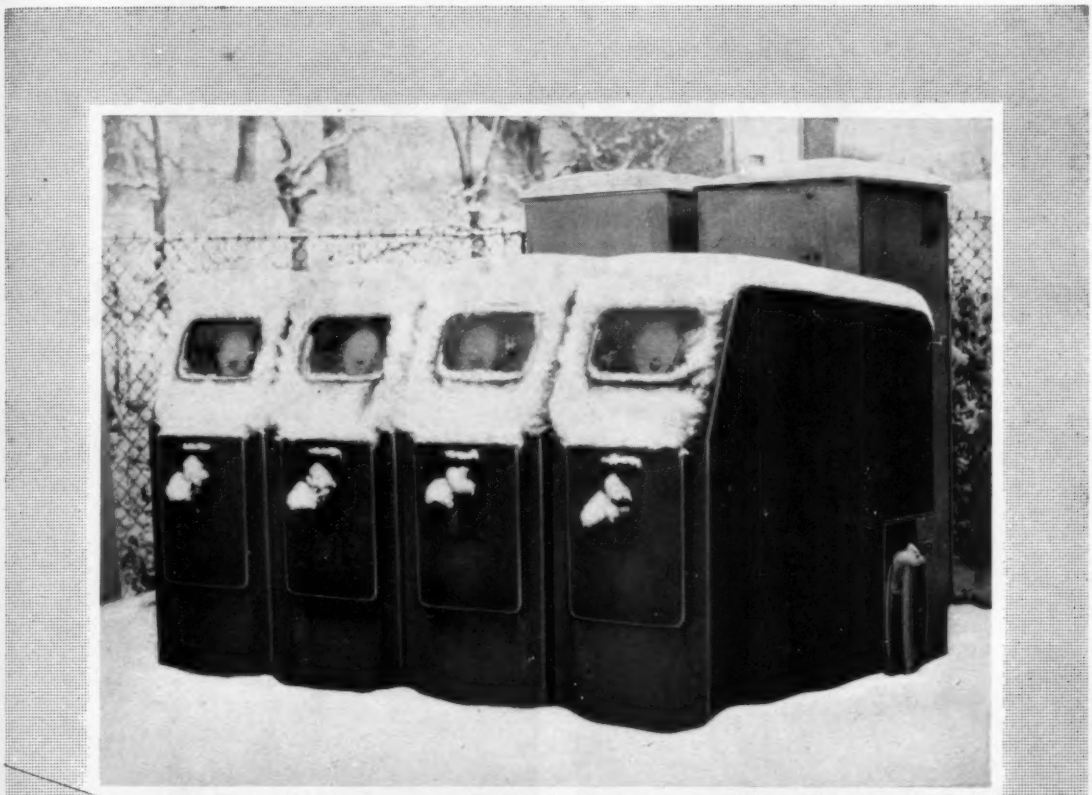
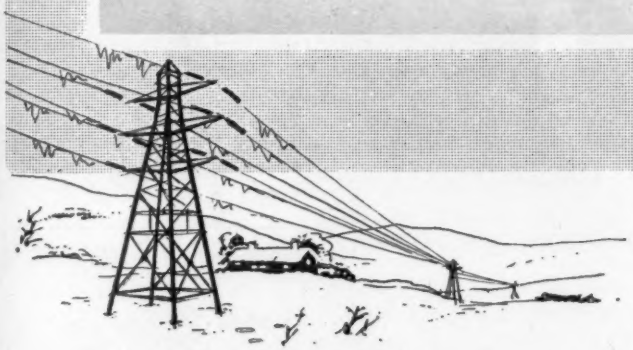
YORKSHIRE SWITCHGEAR
in the Electrical Supply Industry





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The rigours of our winter weather provide a severe test to all outdoor equipment, and with the ever increasing use of electricity, continuity of supply is of vital importance to our well being and affects each facet of everyday life.

Type 1V10 Metalclad Switchgear was designed specifically for outdoor use, and the test of time has proved that it withstands snow and ice equally as efficiently as the heat and humidity of tropical lands.

A complete range of OCBs and oil switches is available for outdoor service at voltages up to 22kV, all tested and certified to B.S. 116 1952 and B.S. 2631 1955.

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Associated with Electro Mechanical Mnfg. Co. Ltd. Scarborough

Your Symbol for reliability...

Yorkshire Switchgear
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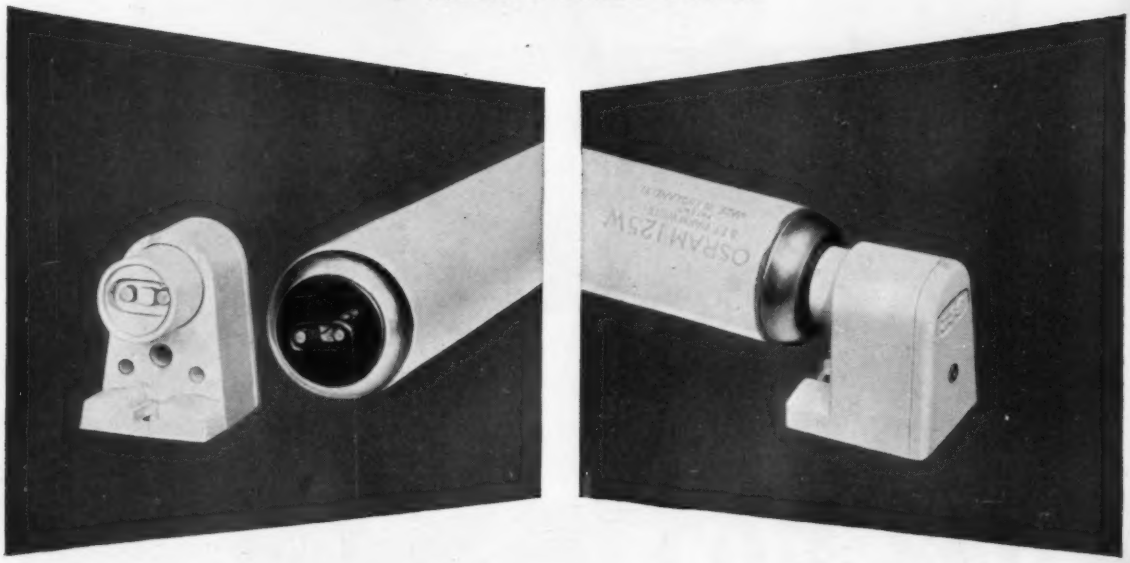
NEW R.D.C.* CAP

FOR

Osram

8ft. 125w. GUARANTEED TUBES

* *Recessed Double Contact*



- Robust central moulded spigot on lamp cap protects recessed contacts and gives easy location when inserting tubes.
- Tube removal or replacement can be carried out single handed from one ladder position at either end of the fitting.
- New cap design gives firm, reliable location and support for the tube without the need for independent clips.
- Electrical connections made by spring-loaded plungers in retractable holders.
- Compact cap and holder unit enables dark area to be reduced at end of fitting.

Osram *FOR PROGRESS AND SUPERB QUALITY*

For use with 8 ft. units in the new

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Fluorescent lighting fittings

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

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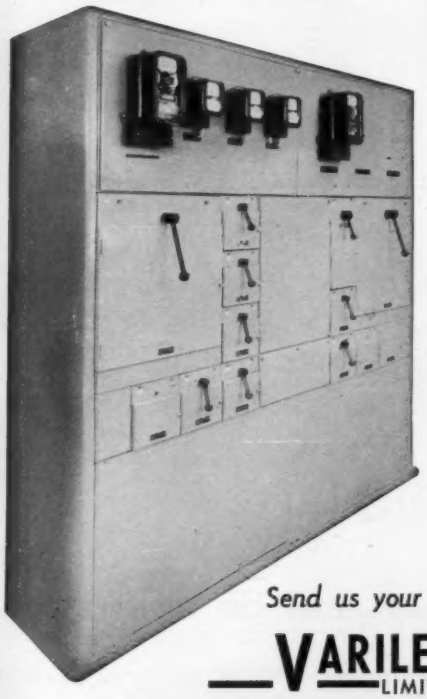

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embodying Combination Fused Switches from our ASTA Type Tested 30 MVA range. 60 amperes to 750 amperes. Standardised dimensions permit ease of assembly. Great flexibility of layout and facilities for extensions.

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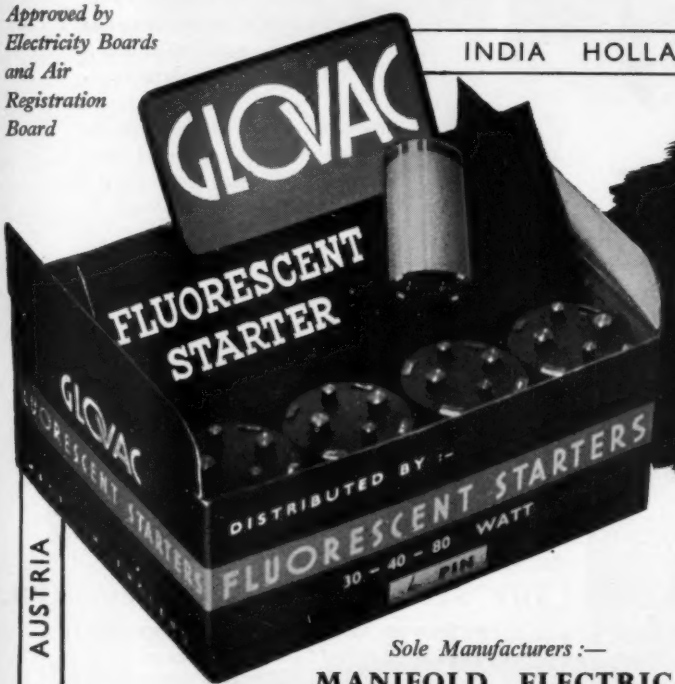

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Ceramic condensers on heavy duty types and solid brass contacts ensure long life and trouble-free operation even in tropical conditions.

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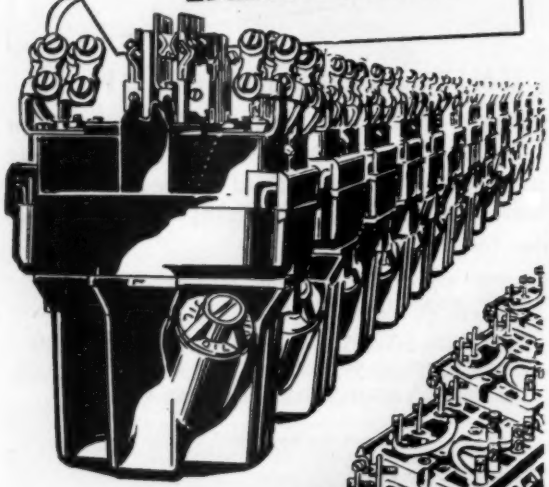

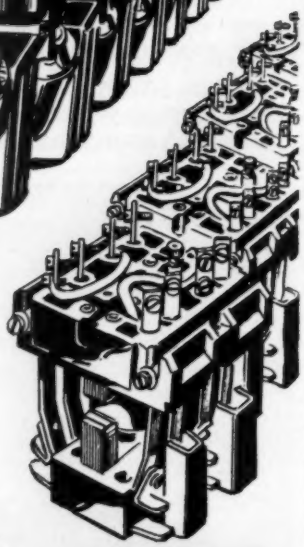

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for the control of heating, lighting, distribution and motors

ALL STANDARD VOLTAGES

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*Type D*10 15 15 *amp. oil immersed—T.P. and D.P.*
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These units are intended for clamping round cylindrical surfaces for local heating. Of the two types available, one is of light and flexible construction and the other is preformed and totally encased.

CRESSALL STEEL JACKETED HEATER UNITS

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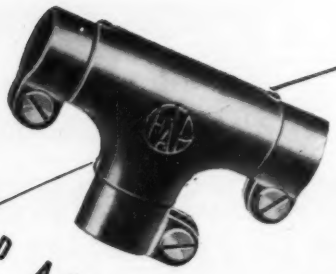
CONDUIT FITTINGS AND ACCESSORIES



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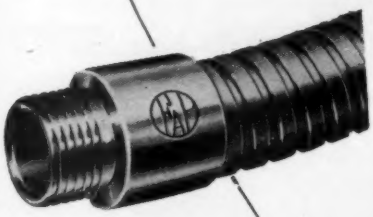

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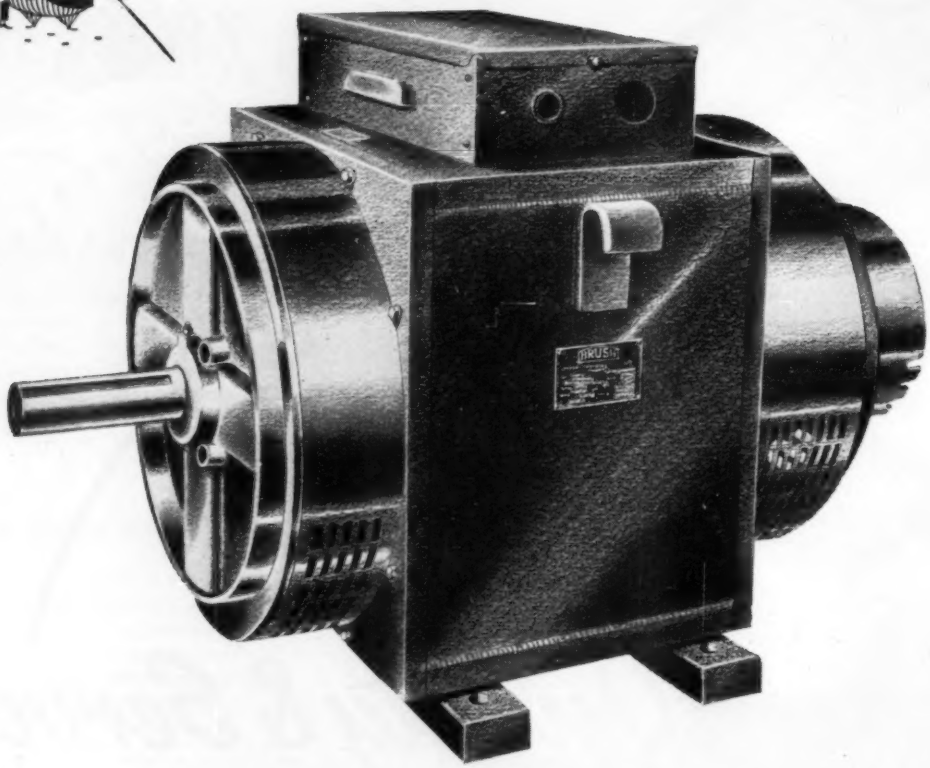
But why choose Brush Square Path Alternators?



Because, sir, by using novel design methods Brush have made their Square Path Alternators absolutely unbeatable. They're space-saving. Easily serviced. Highly efficient. And at a price that is really competitive.

Then, just look at their performance. Take the self-regulated, self-excited type. On lighting loads, for instance, the voltage regulation can be held within plus or minus two-and-a-half per cent, irrespective of normal variations of engine speed or temperature.

Hmm. But, don't forget, our self-contained generating sets are exported all over the world. Will these alternators be as reliable in the tropics or the tundra as they are here?

Absolutely, sir. They are built to operate in any kind of climate. You can rely on that.

And what's the delivery position?

As quick as you like, sir. Within weeks.

Well then—what are we waiting for? Order from Brush.

BRUSH

Two types available: Self-regulated and self-excited with outputs of 1 to 40kVA. Self-excited but externally regulated with outputs of 1 to 62½kVA. 12 or 24 volt D.C. system included. Engine-starting and battery-charging windings can be provided.

Square Path Alternators

For full details, write for Publication No. C1502/AD

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FOR CLOSE CONTROL OF SPACE HEATING

This new Thermostat gives the closest possible control of space heating. Embodying a patented load compensating device, it is easily installed without removing cover and is suitable for wall or conduit box mounting.

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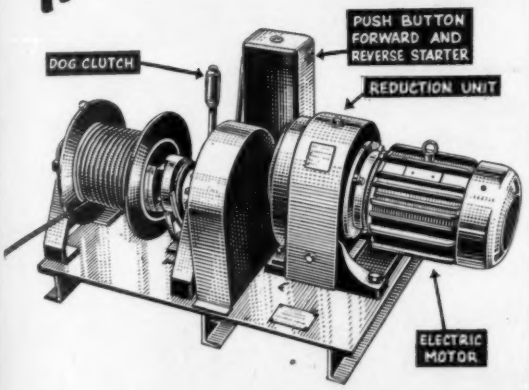

The 3-ton pull Electric Winch with a rope speed of 30 ft. per minute shown above is just one of many electrically powered winches which we have designed specially to meet the particular needs of a customer. Let us advise you on your hauling problem.

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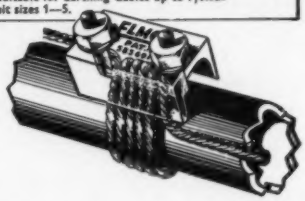
EARTHING CLAMPS

A COMPLETE RANGE TO B.S.951. 1948 IN 4 SIZES

	A123	B45	C67	D8910
for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
to fit B.S. conduit sizes i.e. in trade terms	1, 2 & 3 ½" to ¾"	4 & 5 1" and 1¼"	6 & 7 1½" and 2"	8, 9 & 10 2½" to 3½"

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5.



"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.

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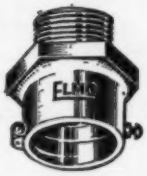
Flexible-to-rigid CONDUIT COUPLINGS

Made in zinc base alloy in the following sizes

Electric Thread (Male)	⅜"	½"	1"	1¼"	1½"	2"
Inside Diameter	⅜"	½"	1"	1¼"	1½"	2"
Electric Thread (Male)		⅜"	½"	1"	1¼"	
Inside Diameter Flexible Conduit		½"	⅝"	¾"	1"	



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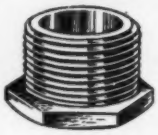
Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal threads suit all makes of flexible tubing.



CONDUIT BUSHES

Made in the following sizes:

MALE: Electric Thread
⅜" ½" 1" 1¼" 1½" 2"

FEMALE: Electric Thread
⅜" ½" 1" 1¼" 1½" 2"

MALE
Hex. Section

FEMALE
Flat Face Section for Spanner (except ⅜" size, which is round)

CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed ⅜" thread, male electric.

Made to fit all standard boxes with two holes 7/32" diameter — 2" centres diametrically opposed. Designed in accordance with British Standard Specification.

Both made in aluminium alloy

CEILING PLATE
One hook

Manufactured by **M. MOLE & SON LTD.**
BIRMINGHAM · 3 · ENGLAND Est. 1835

For ● **TAGS AND TERMINALS**
(Soldering and Crimping)

- HAND PLIERS FOR CRIMPING
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- FIXING TOOLS FOR WIRE END TERMINALS
- BRASS AND COPPER SOCKETS
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Clamps
to suit all sizes of
CABLES
Single or trefoil
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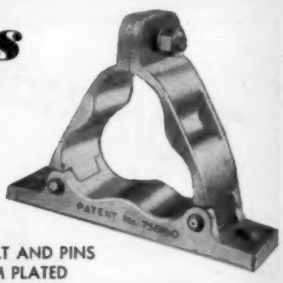
Alternative fixings



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CADMIUM PLATED

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Specialist pattern makers and non-ferrous founders
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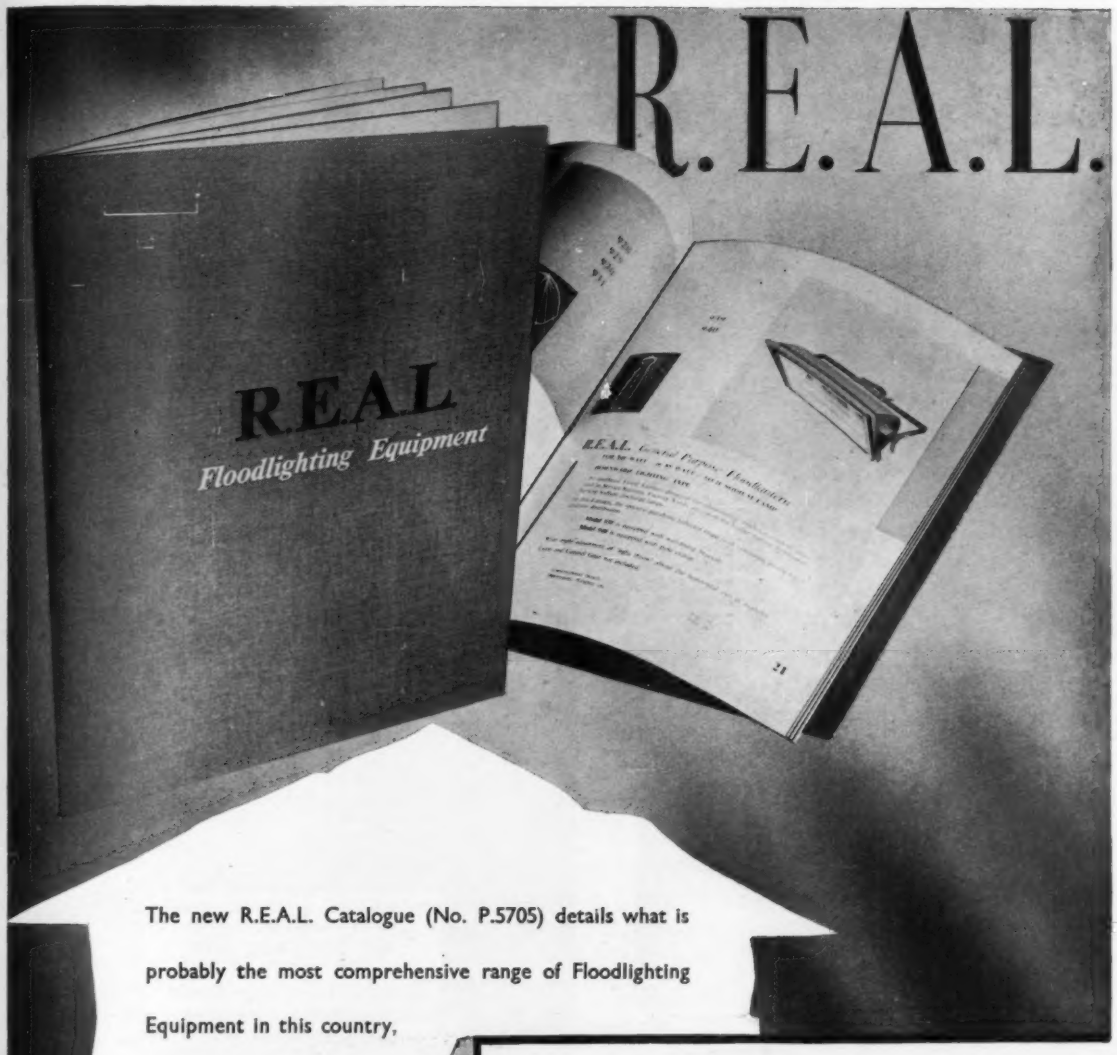

The new R.E.A.L. Catalogue (No. P.5705) details what is probably the most comprehensive range of Floodlighting Equipment in this country, forming a complete survey of all that is best in new and well-proven Lanterns.

Have you had YOUR copy?

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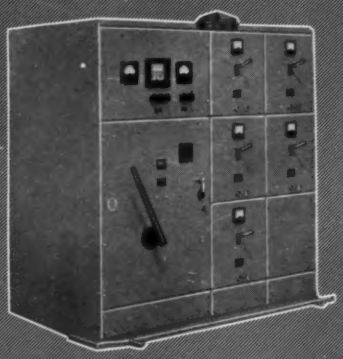
MARCH 25th to 29th 1958
Stand No. F4

Issued by ROWLANDS ELECTRICAL ACCESSORIES LTD. R.E.A.L. WORKS BIRMINGHAM 18

...for A/C & D/C SWITCHGEAR

A typical example of an OPEN TYPE D/C SWITCHBOARD as supplied for Steel Works and marine installations.

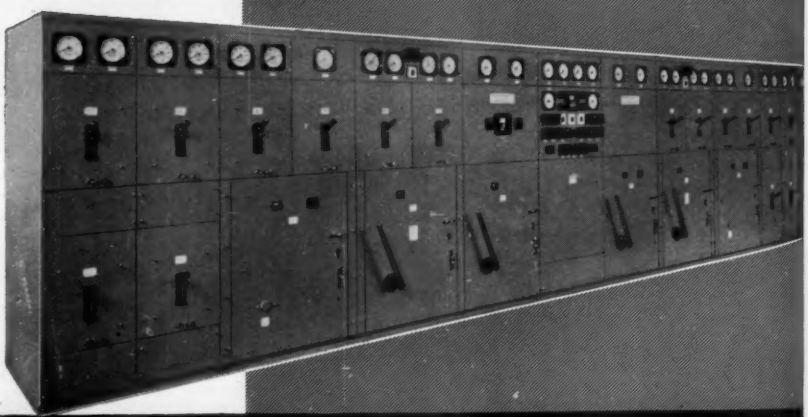


A fine example of an A/C BOARD constructed for a large steelworks in this country.

The above photograph shows in some detail an A/C INDUSTRIAL TYPE SWITCHBOARD supplied to a large tyre manufacturer.

A D/C CUBICLE TYPE SWITCHBOARD equipped with withdrawable D/C breakers, as supplied to Harbour Boards, Steelworks and Atomic Power Stations.

ALL A/C BREAKERS ARE CERTIFIED IN ACCORDANCE WITH B.S.S. 116 & 936 for 25 and 31 M.V.A. at 400 volts.



WHIPP & BOURNE LIMITED

SWITCHGEAR SPECIALISTS | CASTLETON ROCHDALE LANCS

H.R.C. FUSE-LINKS

Compliance with British Standard

B.S.88:1952 requires tests to be taken to prove compliance with the following:—

Clause 15: Insulation Resistance.
Clause 16: Temperature Rise at current rating.
Clause 17: Time Current Characteristics.
Clause 18: Minimum Fusing Current.
Clauses 19–22: Short Circuit Performance.

All 'ENGLISH ELECTRIC' H.R.C. Fuse-Links to B.S.88:1952 listed in our Price List FG/127B have been fully tested to Clauses 15–22 inclusive proving compliance in all respects with B.S.88:1952 and Certificates of Short Circuit Rating have been issued by the Association of Short Circuit Testing Authorities.

IMPORTANT

When any change, however small, is made in design, materials, or methods of construction of an 'ENGLISH ELECTRIC' H.R.C. Fuse-Link likely to affect its performance, it is re-tested to Clauses 15–22 inclusive and proved to comply with B.S.88:1952 in all respects before being manufactured for sale.

Install

'ENGLISH ELECTRIC'

and be safe

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

Fusegear Division, East Lancashire Road, Liverpool, 10

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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IF IT'S *Action* YOU'RE

Critical moment, this,

when brain and sinew must work as one to get the most out of the wind! Fast, co-ordinated action is the essence of successful racing sailing—and the secret of the success of Henley service. If you want wiring cables . . . and you want ACTION . . . you want Henley's!

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P.V.C. INSULATED ONLY

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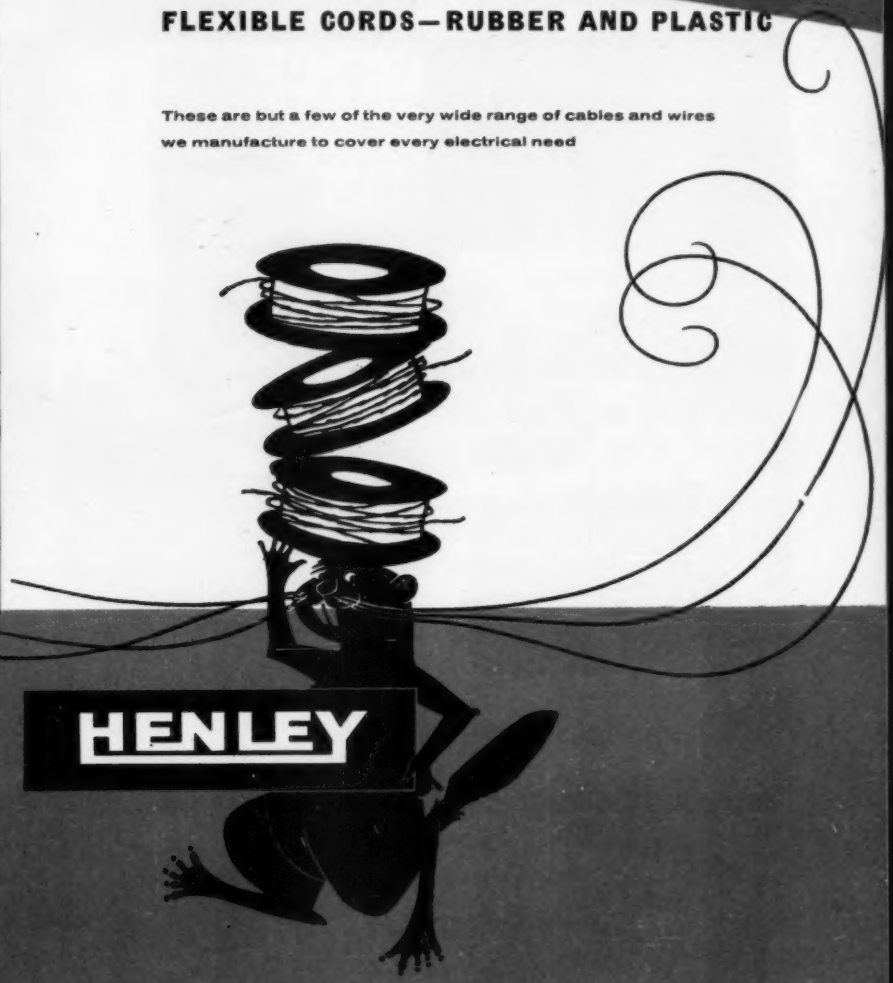
FLEXIBLE CORDS—RUBBER AND PLASTIC

These are but a few of the very wide range of cables and wires we manufacture to cover every electrical need



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A Nation-wide network of 28 Henley Branches brings you the cables you want

...where you want them

...when you want them

W.T. HENLEY'S TELEGRAPH WORKS CO. LTD · 51-53 HATTON GARDEN · LONDON E.C.1 · CHAncery 6822

Cook, wash and warm with Jackson

The Jackson Jill Waterheater —the latest Jackson line— 3 gallon model £16.3.0. and 1½ gallon model £15.1.0. *incl. P.T.*

The Jackson Washboiler— demand is great—a proven winner. Model 908 £12.2.0. Model 909 £13.17.0.

Jackson have increased their range of Electric Fires. Available in "House and Garden" colours. Ask to see the complete range.

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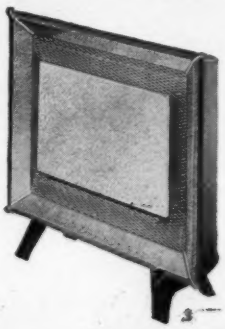

Most Jackson products can be colour matched in the kitchen, in a Turquoise Blue, or Eau-de-Nil Green, apart from All-Cream or All-White.

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Copies of the 2nd Edition of the Jackson Domestic Catalogue in full colour are available free on request. Send in your requirements now.

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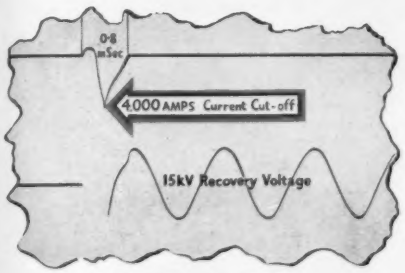
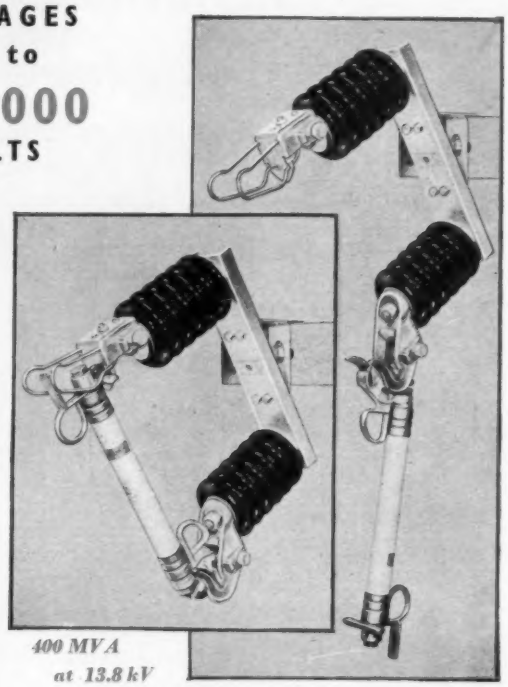
Branches: Belfast, Birmingham, Cardiff, Glasgow, Leeds, Liverpool, Newcastle-on-Tyne

EMP CURRENT LIMITING *High Voltage* HIGH RUPTURING CAPACITY FUSES

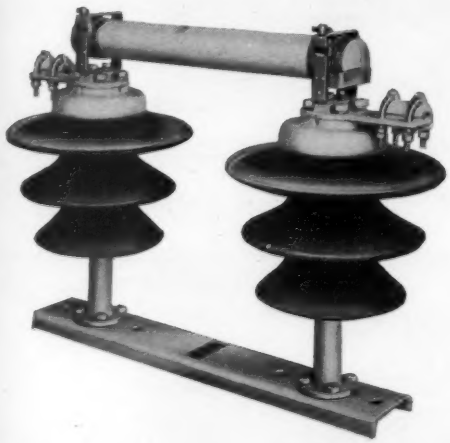


1000 MVA at 15 kV

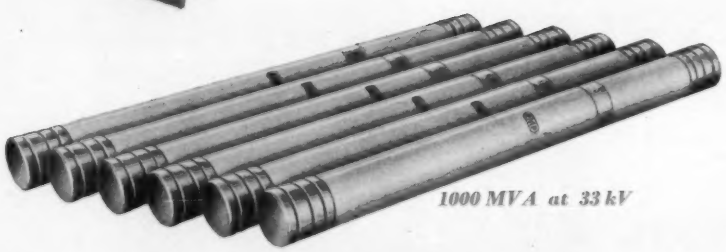
FOR ALL VOLTAGES up to 132,000 VOLTS



400 MVA at 13.8 kV



Tested to B.S. and NEMA standards



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250 MVA proved performance:
6.6 kV and 11 kV tripping fuses rated 60 Amps for use in air and under oil

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***THE** SOURCE*

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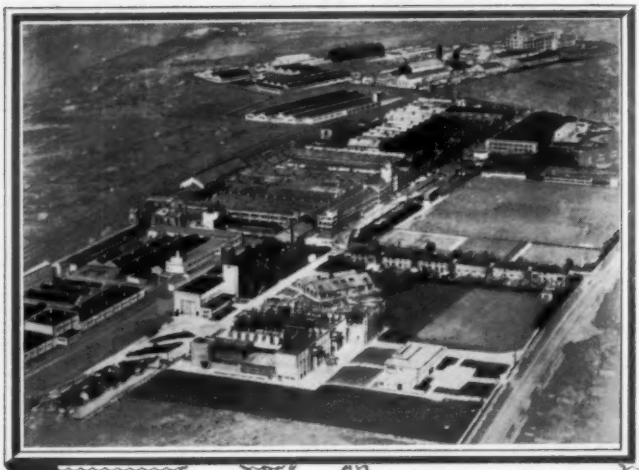

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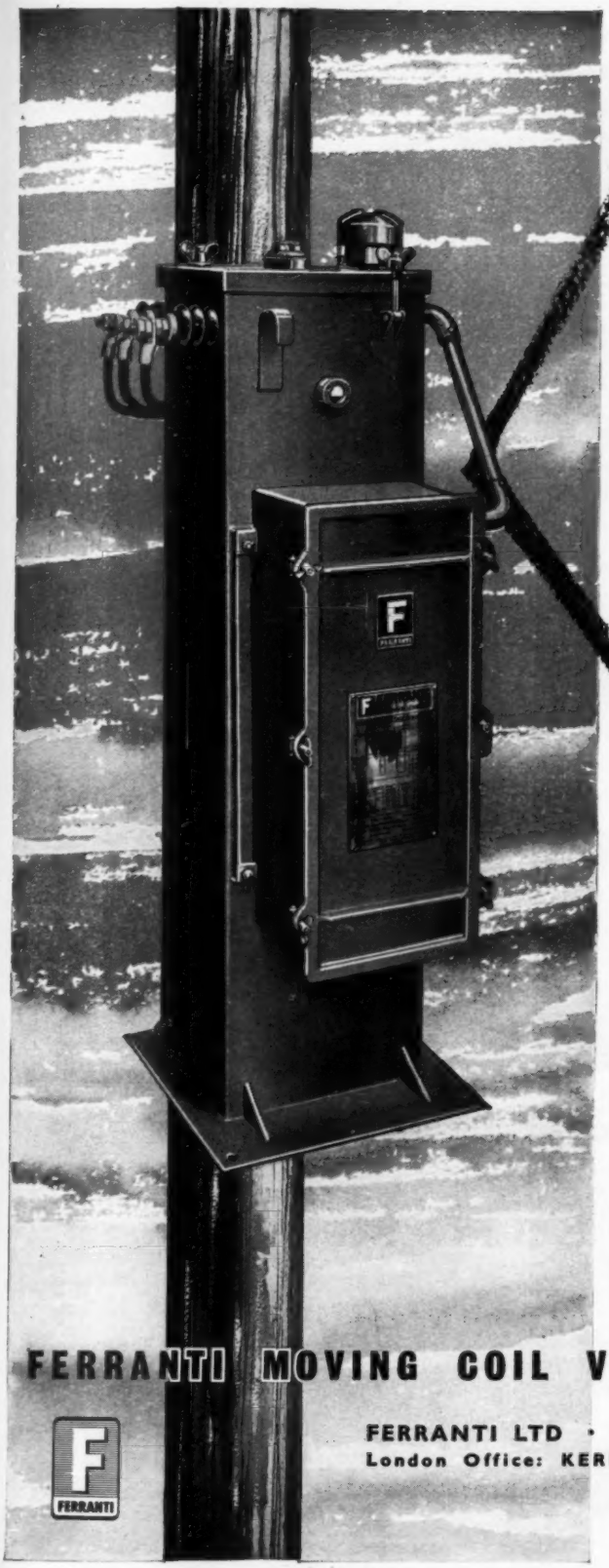

This regulator can solve 4 different voltage problems

* Gives alternative voltage ranges of
  +0% to —11%
  +0% to —20%
  +10% to —10%
  +10% to —18%
  on nominal 200-250 volts single phase supplies.
* Enables voltage regulation to be suited to system requirements.
* Two sizes available — maximum ratings 16 kVA and 25 kVA.
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3-Voltage Insulation Tester Series 2

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Testing pressures 250, 500, 1,000 volts = Range 0–200 megohms.

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Scale remains the same for each testing pressure.

Pressure selection switch incorporated.

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Self-contained instruments for measuring directly the resistance to earth of earth plates and earth specific resistance.

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A wide selection of ammeters, voltmeters and wattmeters. Round or square faced patterns available.

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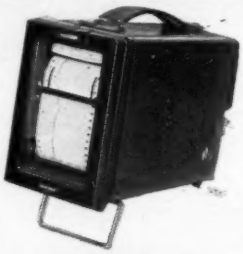
Moving iron or moving coil ammeters, voltmeters and dynamometer wattmeters. Industrial and Laboratory types available.



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A compact tapping type instrument suitable for either flush or projecting mounting, or for portable use. Variable chart speeds. Other single and multi-pen types of recorders available.

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This small pencil type gauge can be used for measuring the thickness of non-magnetic coatings such as paints and plating on ferrous bases.

Range 0.0002–0.015 inches.

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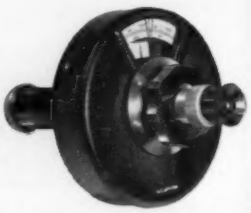
A highly efficient quick and simple analytical instrument available with or without recording facilities.



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A high precision direct reading instrument for measuring the temperature of visible radiating bodies quickly and accurately without actual contact.

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An essential instrument for industries where water purity is of prime importance. Detects dissolved impurities in steam or water. Models available for Power Stations, Marine installations or Laboratories.

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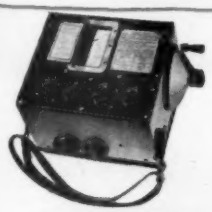

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Combined Insulation Tester and Wheatstone Bridge. Ideal for measuring to a high degree of accuracy, insulation resistance and a wide range of conductor resistances; also fault location on telephone cables.

Testing pressures up to 1,000 volts.

Ranges up to 2,000 megohms.

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For routine tests on cable bonds, earthing conductor joints, lightning conductors, etc.

Available in two types:
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A direct reading instrument having four or five different ranges, measuring from a few ohms down to 1 microhm. Equipment includes battery and special testing spikes.

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For rapid measurement of insulation and conductor resistance of components during manufacture. A mains operated direct reading ohmmeter. These instruments are available for Switchboard or Bench use.

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The widest range of small motors available for servo mechanism or special purposes. A.C. or D.C.

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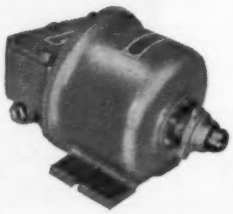
Supplied to shipbuilders throughout the world since 1893.



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Speed indication for ship, turbine, printing and power shaft revolutions.

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For surveys by resistivity method, ideal in prospecting for mineral deposits, shallow water supplies and depth of bed rock for dam foundations.

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'KENLEY' practical easy clean 'PERSPEX' trough fitting for the school, the office. Single and twin 5 ft and 4 ft units

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Manufacturers of Industrial, Commercial and Decorative Fluorescent Lighting

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TYPE No. 2B—BENCH MODEL

CAPACITY ¼", ⅜" and 1" outside diameter electrical conduit.
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FEATURES

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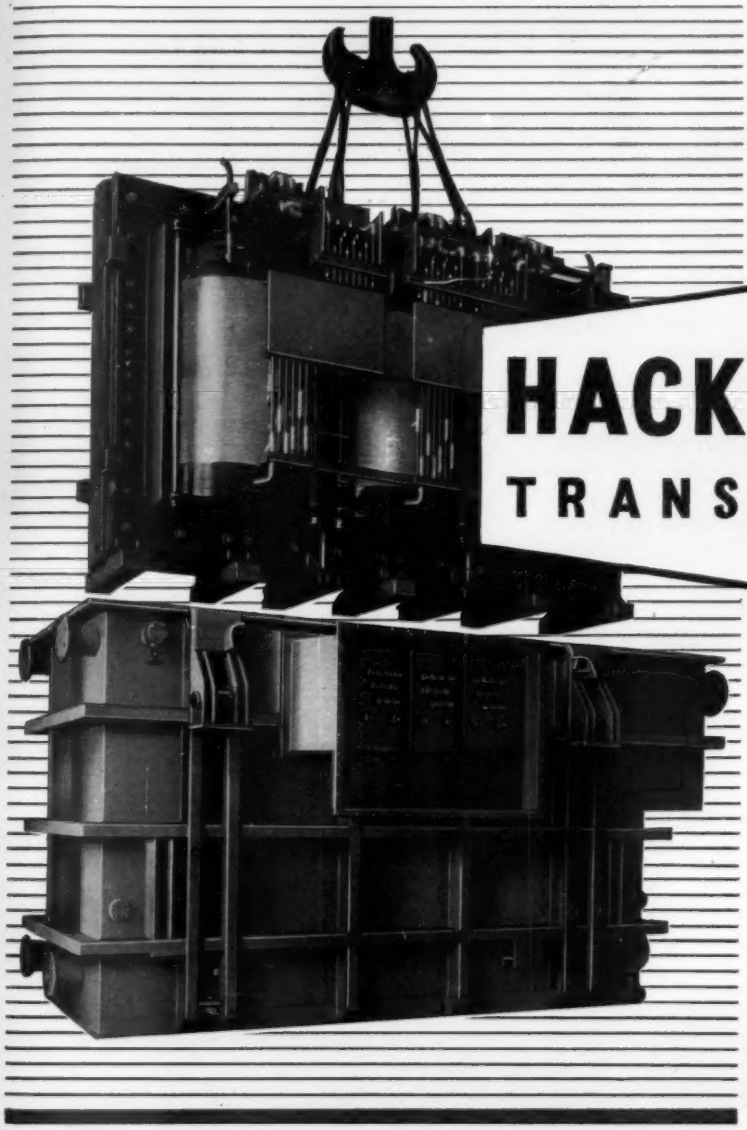

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Typical 45 MVA Hackbridge transformer 66/33 kV. type ON/OFB, for British Railways.

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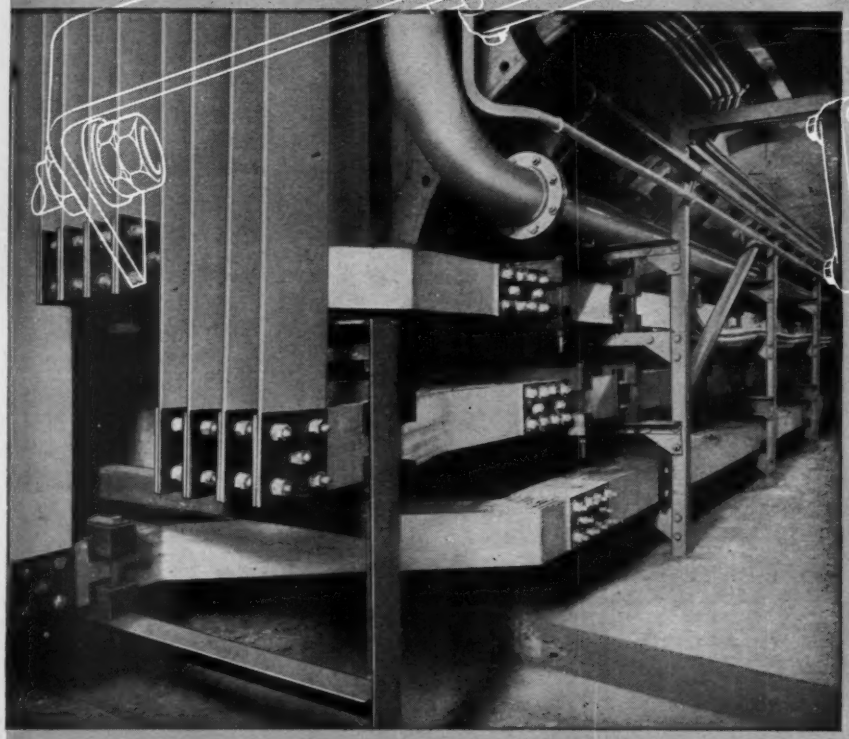

Aluminium for busbar is no longer a novelty — experience has proved its right to be considered on equal terms with copper. Sometimes, conditions will weigh the balance in favour of the more conventional material. In many instances, aluminium is more economical and equally efficient, particularly when 'Kynal' Busbar Jointing Compound is used to ensure strong, corrosion-resistant joints.

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the name is 'KYNAL'

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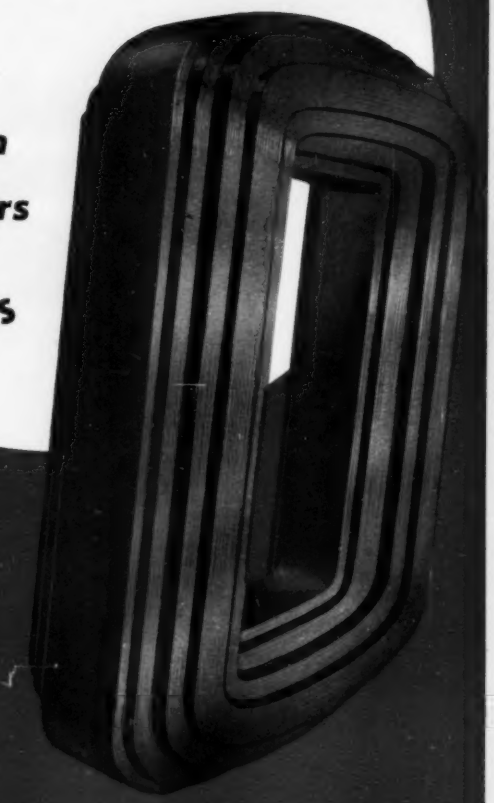
TELMAG

strip wound cores

for rural distribution transformers

Guarantee lower power losses



TELMAG Strip Wound Cores in Grain Oriented Silicon Iron are now widely used in Power Distribution Transformers throughout the world. We offer transformer manufacturers overseas an outstanding service in this field.

- ★ We are specialists in the manipulation of grain oriented silicon iron alloys, and supply a wide range of wound cores for transformers and chokes.
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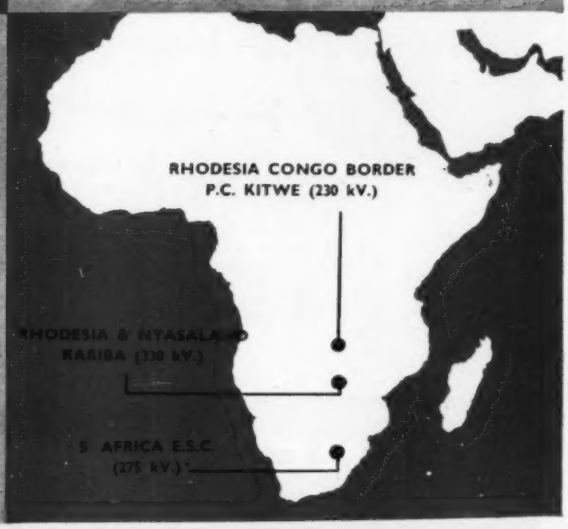

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Who caught us up near Leeds?
That was when the Spencer stage ran
Past all record speeds.
Flying thundering hooves drew near,
Our nags collapsed with fright.
The coachman's rising shriek of fear
Dissolved into the night.
A thousand deaths we must have died —
The villain watched us quiver.
"I only want your wire" he sighed*
"How soon can you deliver?"

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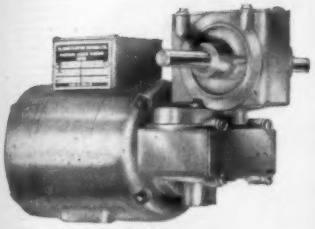
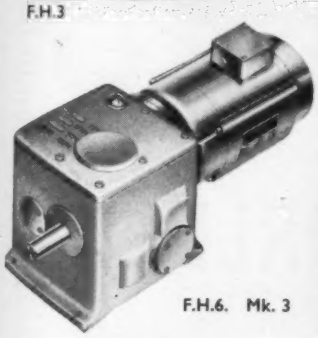
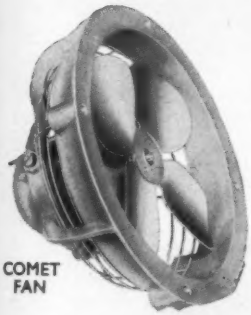
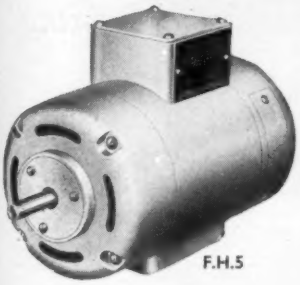

F.H.5

F.H.3


F.H.6. Mk. 3


COMET FAN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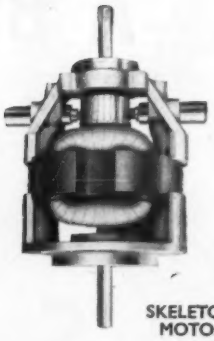
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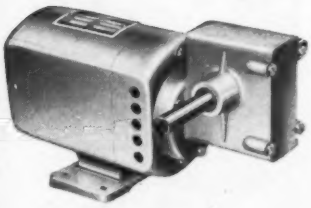
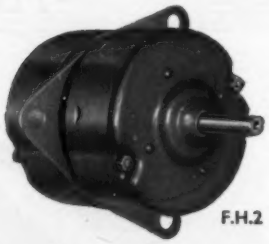
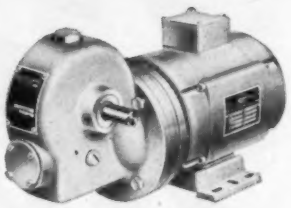

F.H.4 GEARED

VARIABLE SPEED F.H.6


F.H.2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- **VARIABLE SPEED F.H.6 MOTORS**
  A.C. current 100-250 volts. H.P. 1/8, 1/6 or 1/5
- **POLISHERS AND GRINDERS**
  1/15 h.p., 6000 r.p.m. 1/6 h.p., 5000 r.p.m.
- **DOUBLE GRINDERS**
  1/15 h.p., 6000 r.p.m. 1/6 h.p., 5000 r.p.m.

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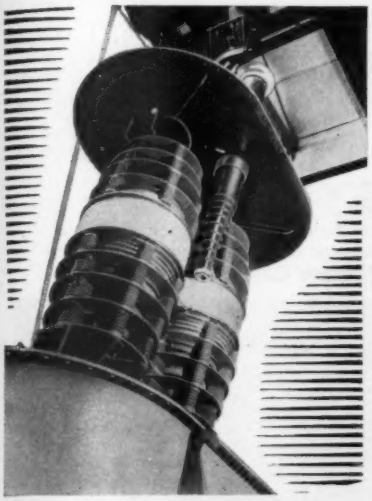

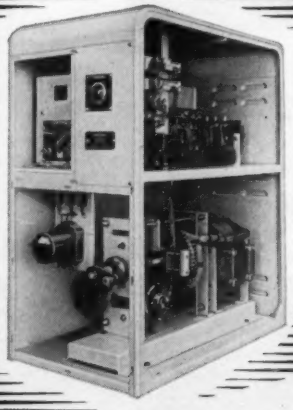

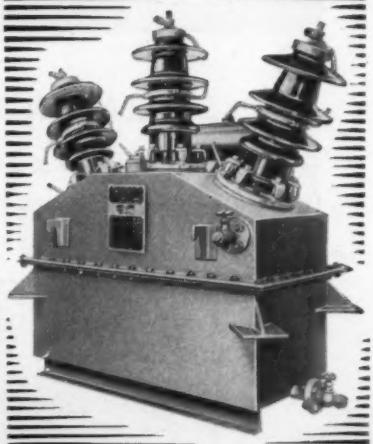

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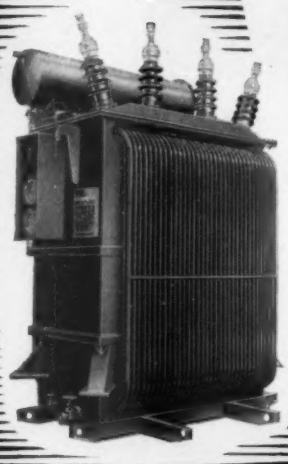

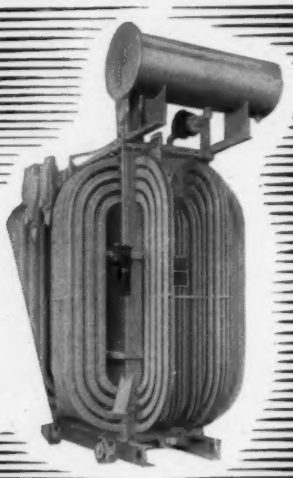

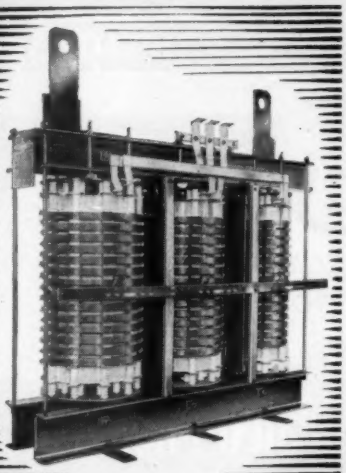

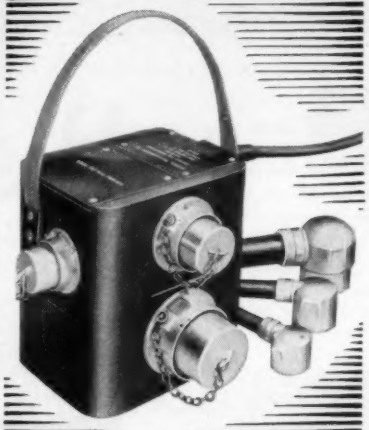

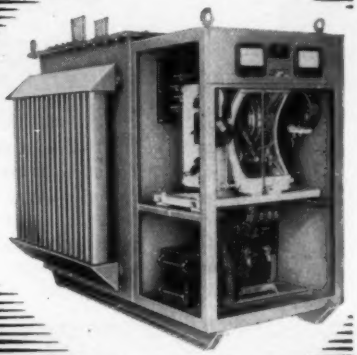

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C1

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A range of electric tools for increasing the output per man by stepping up the electricity supply to 200 cycles, thus providing a high, maintained working speed. Other advantages are: greater reliability because there are no armature windings to burn out, greater power with no increase in weight, and absolute safety because of only 72 volts to earth. If you use six or more portable electric tools, you can definitely increase production and reduce maintenance by installing Hicycle.

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ELECTRIC PRODUCTION TOOLS

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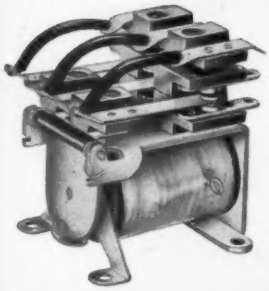
CP188

Thorn

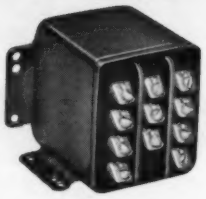
Vibration-proof relays

FOR AIRCRAFT AND INDUSTRIAL USE



These relays of simple and robust construction are designed to work under adverse conditions. The use of such features as high contact pressures and generous wiping action enable them to comply with the Service requirements of DES.1 and DEF.5000.

Both sealed and open types are available with up to 4 pole changeover contacts. The standard relays operate on 28 volts D.C. and enquiries for other operating voltages are welcome. Hermetic enclosure of the sealed types ensures complete freedom from the effects of humidity, altitude and tropical exposure. Also the case protects the relay from mechanical damage and operator interference.



SWITCH 10 amps A.C. (115 volts) or D.C. (28 volts)

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The power generating plant illustrated is installed at the Rum Jungle Uranium Mine, Northern Territory, Australia, and supplies the growing electricity requirements of the mine and its associated township. The plant comprises three 6-cylinder and one 8-cylinder Allen type T47 diesel engine-driven generating sets which provide an aggregate continuous power output of 2130 kW at site.

Allen two-stroke and four-stroke engines and complete diesel generating sets, A.C. or D.C., for industry and essential services, comprises the following types:

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All engines may be run at lower speeds with correspondingly reduced outputs

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Specialists in complete power generating plant installations

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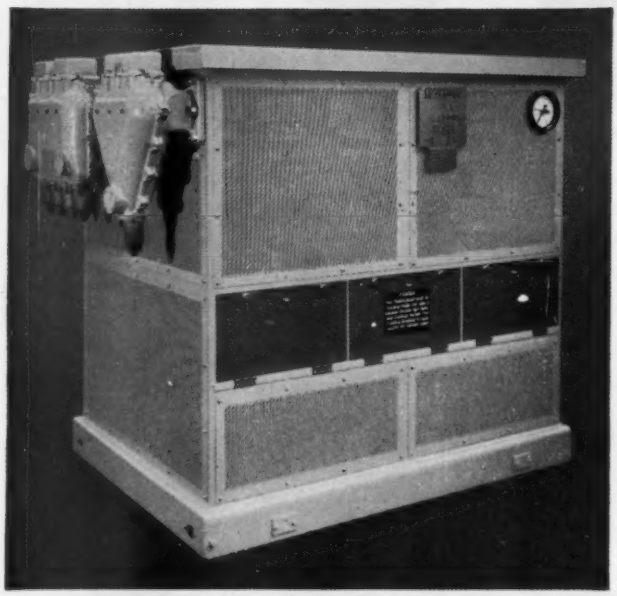
The benefits of silicone-insulated dry-type transformers are becoming better and better known:

* **No fire or explosion risk**
* **Reduced maintenance**
* **Frequent overloading permissible**
* **Smaller size and weight than O.N. or Class B units**
* **Dust, humidity and ventilation are no problem**
* **Can be placed at load centre, therefore making shorter low-voltage cable runs possible.**

The photograph below shows a 500kVA Ferranti dry-type, air-cooled distribution transformer with Class 'C' silicone insulation — B.S.2757 : 1956.

MS

Silicone insulated dry-type transformers ARE SAFER!



Here is a list of well-known British manufacturers already producing silicone-insulated dry-type transformers for the United Kingdom and overseas. These transformers have already been installed in:

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Newspaper plants · Food factories
Flour mills · Coal mines
Underground sub-stations
Office buildings · Blocks of flats
Departmental stores
Radar and airfield sites

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Midland Silicones Limited manufacture in Great Britain the full range of silicone resins and elastomers used by transformer manufacturers in the construction of silicone-insulated dry-type units.

TRW/MS 91

for your current needs

when it is a question of an ever dependable supply of D.C. from A.C. mains remember that Crypton quality-produced equipment enjoys a world-wide and enviable reputation for quality, economy and service.

An enquiry today will receive immediate attention from this progressive Lancashire Dynamo company.

Crypton Ltd. has been built up on a policy of courtesy and a down-to-earth realisation of the true needs of the industries it serves so well.

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P618

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By using Hivac Neon Indicators in your product you will have a new sales-plus feature that the customer will appreciate: for these little red lights are a very effective reminder to him that his appliance is switched on. He benefits from convenience, economy and safety, and you benefit from bigger sales.

be a jump ahead- fit a Hivac neon

It just glows to show!

Hivac Neons can be used in practically every type of domestic electric appliance. They are inexpensive to install and are better than ordinary filament lamps; these reasons show why:

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N5

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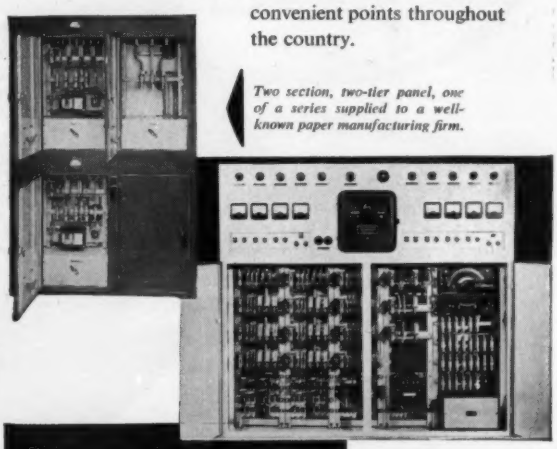
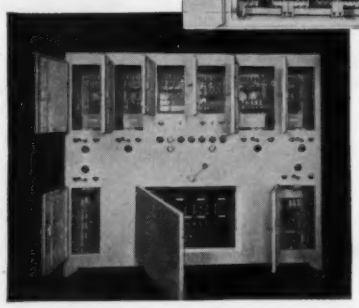
G.W.B. design and supply centralised control panels for many industrial applications. Available in a variety of forms, these panels conform to the most stringent specifications. Contactors, relays and isolators controlling individual machines are contained within separate compartments, and all maintenance and replacement of contactors and ancillaries may be carried out from the front. G.W.B. engineers are available for the solution of circuit problems and any special operational requirements. Sales and service staff are situated at convenient points throughout the country.



Two section, two-tier panel, one of a series supplied to a well-known paper manufacturing firm.



Special purpose panel supplied for the control of an automatic brick-making plant.

Multi-motor control panel with individual compartment and isolation for each motor starter; supplied to a large synthetic fibre manufacturing concern.

All contactors are made to the famous G.W.B. standards. Among the many refinements making them pre-eminent in their field are:

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G.W.B. Low Tension control gear 10—1,400 amps A.C. & D.C.

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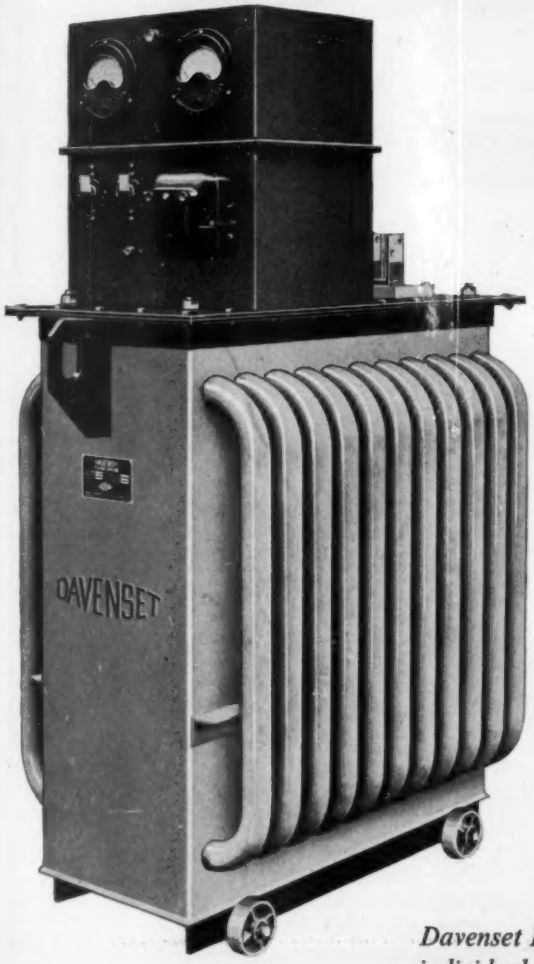
Power for plating



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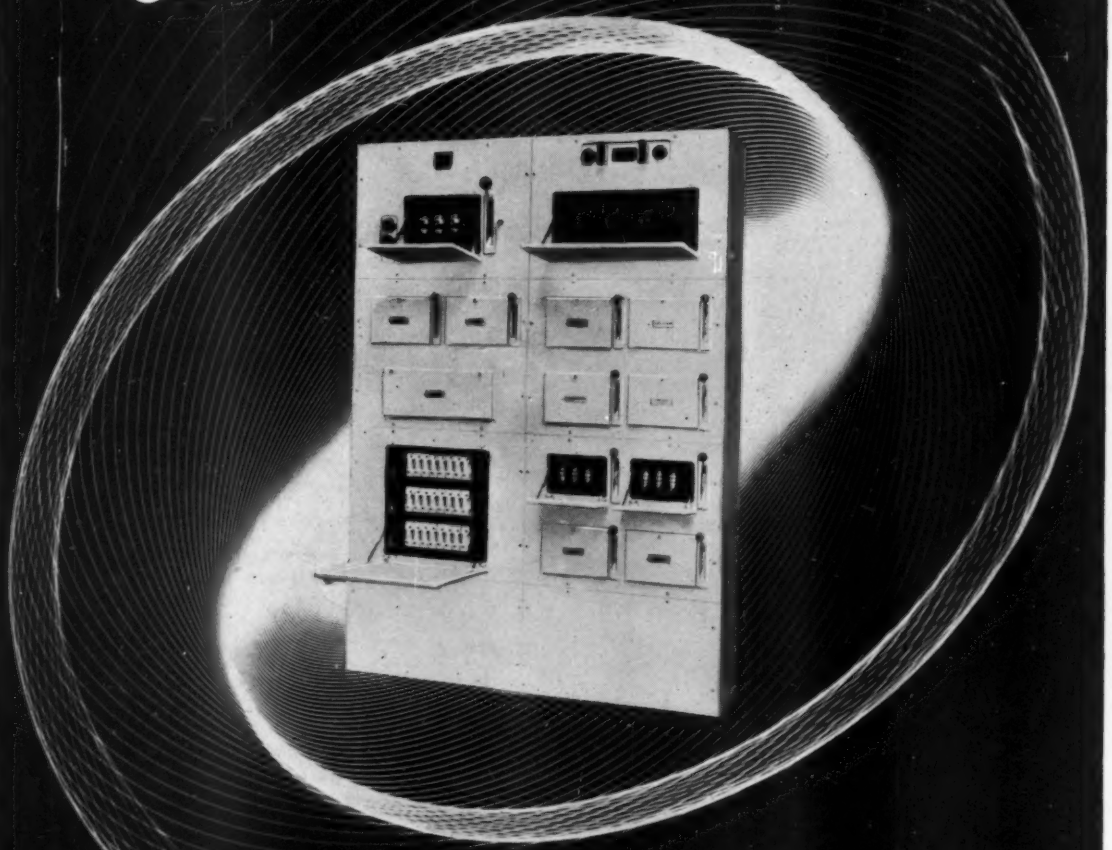
central power control



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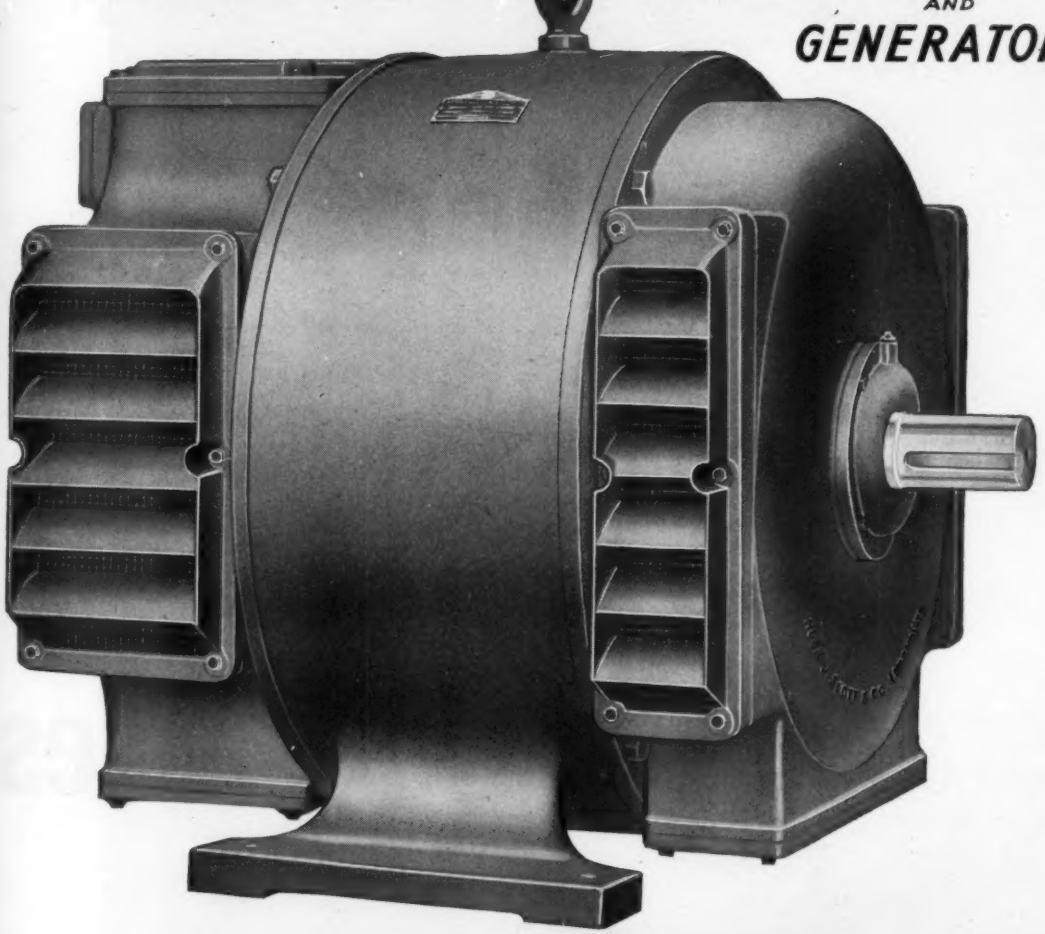

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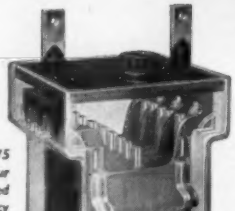
DP stationary batteries



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For whatever purpose a stationary battery is required, in any capacity from 10 to 15,000 ampere-hours, there is a D.P. type specially designed to meet the need with the utmost efficiency and economy.

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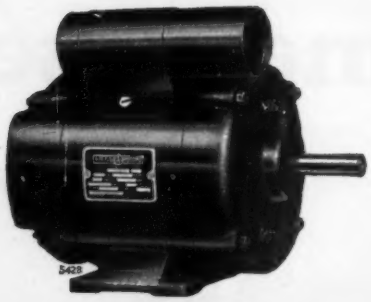

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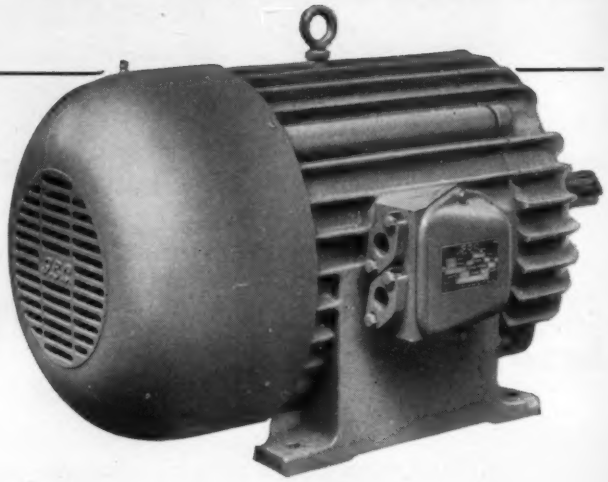

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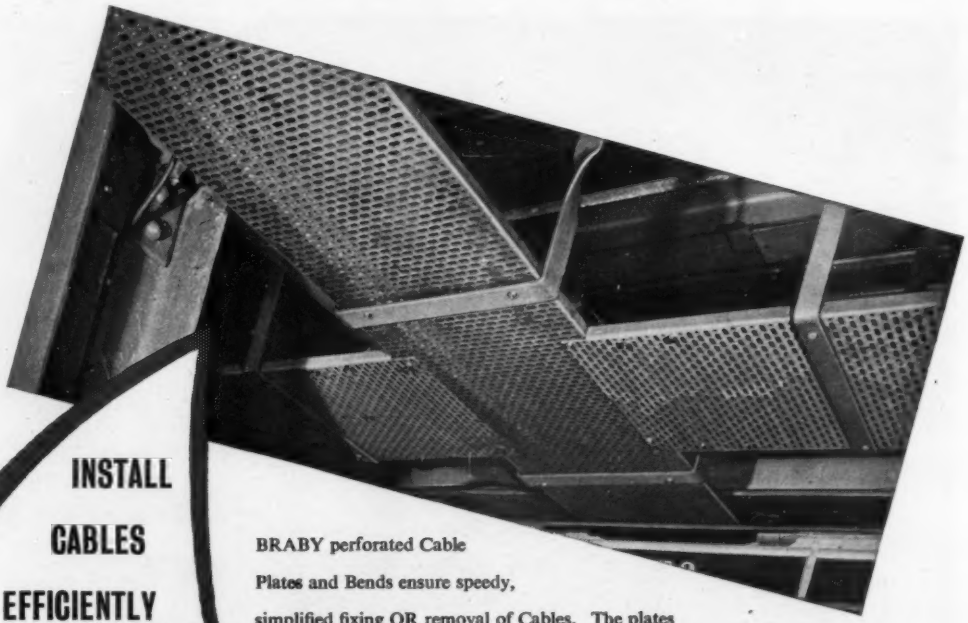

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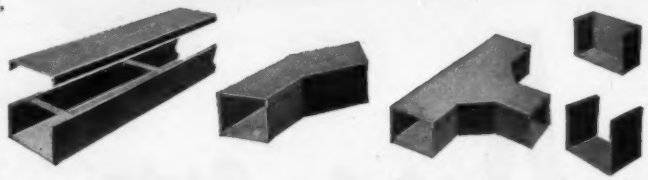

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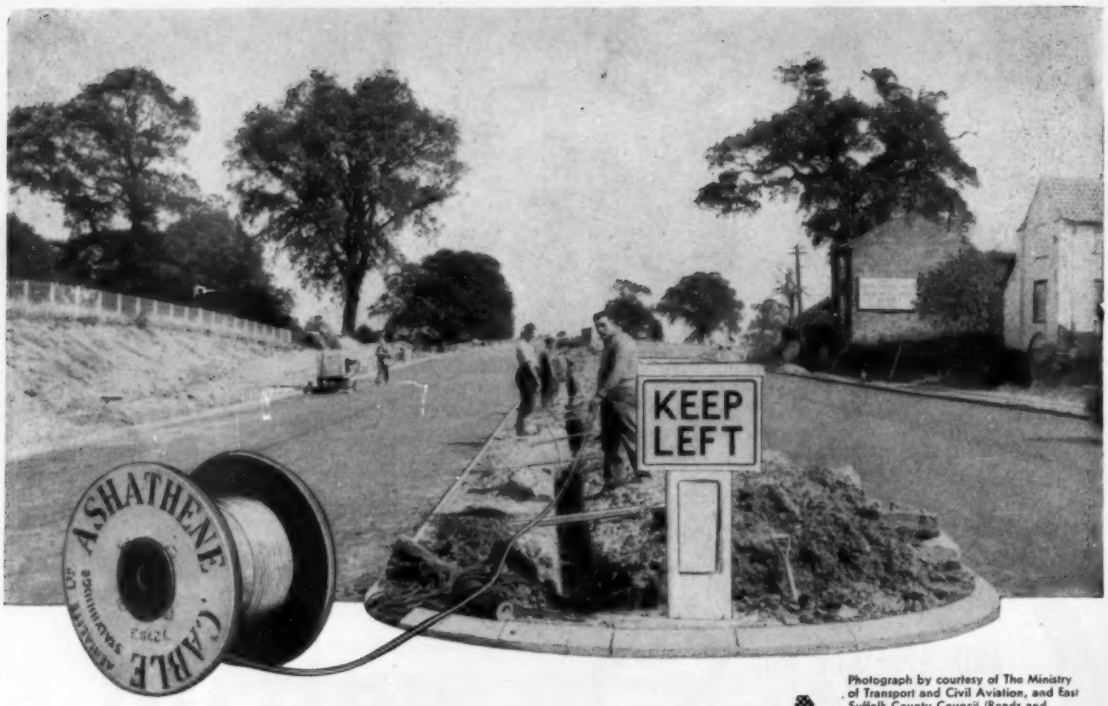

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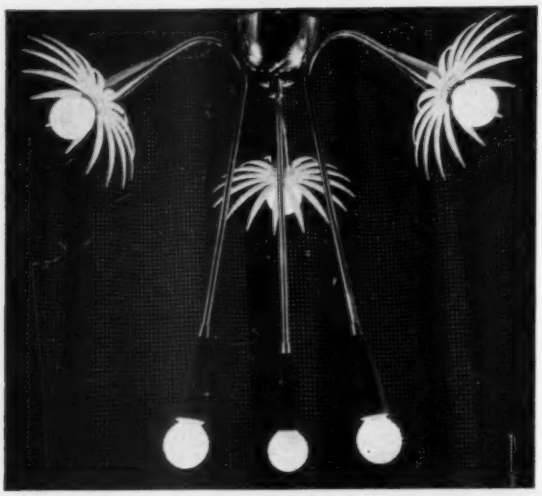

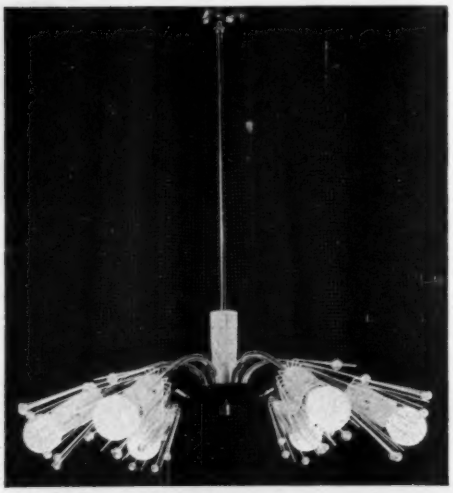

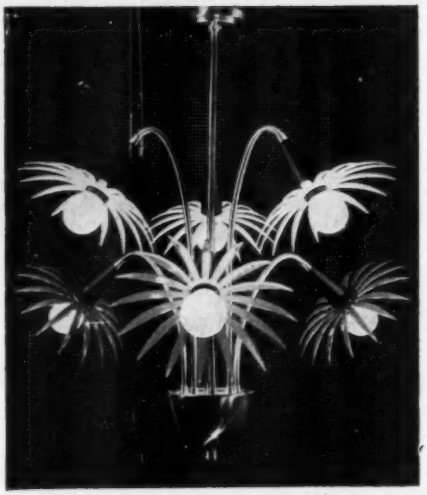

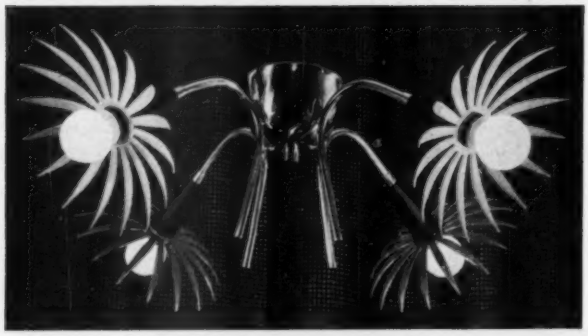

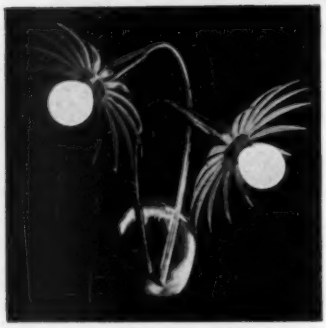

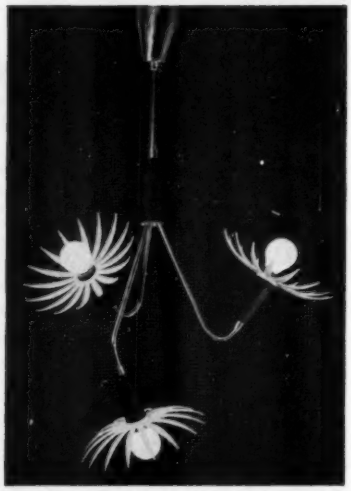

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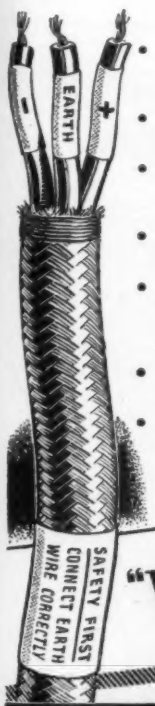

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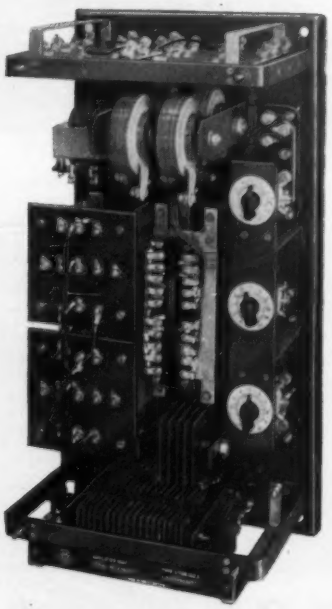

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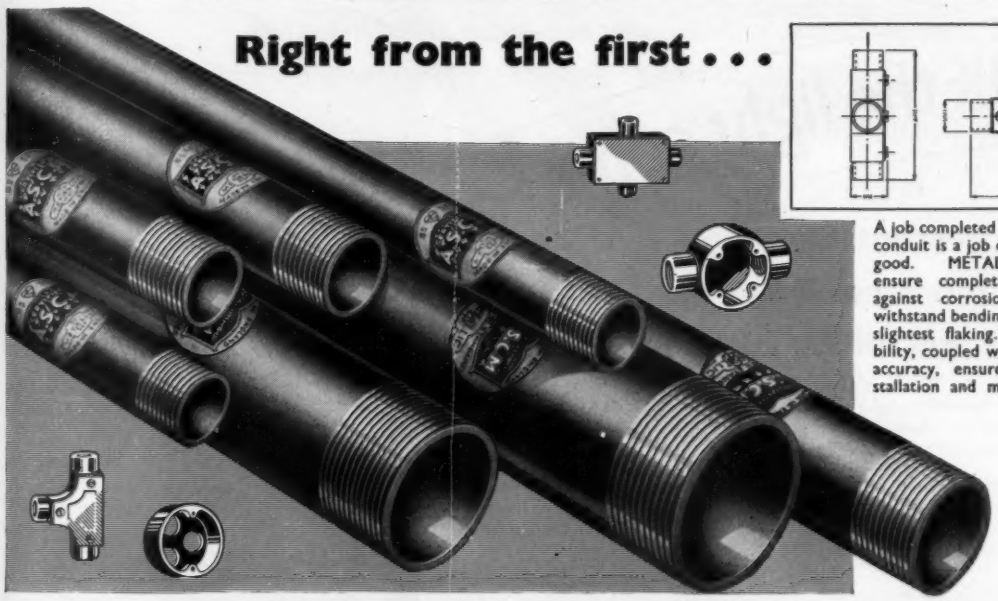

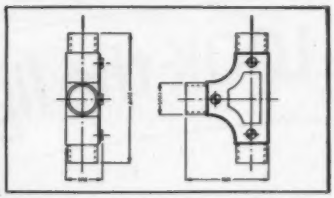

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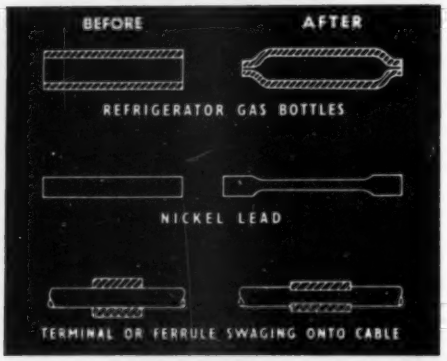
Reducing powder filled steel inconnel and copper elements Tungsten and Molybdenum wire for filaments. Necking refrigerator gas bottles.



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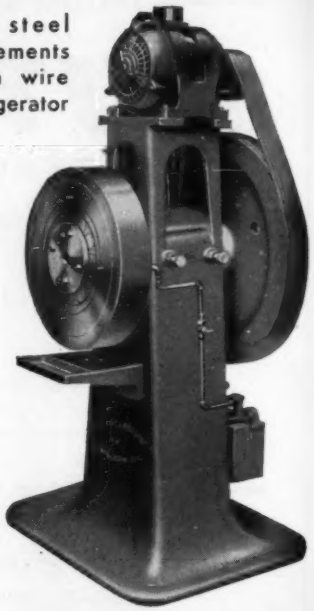

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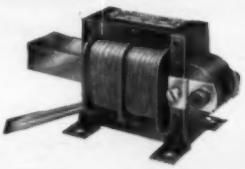

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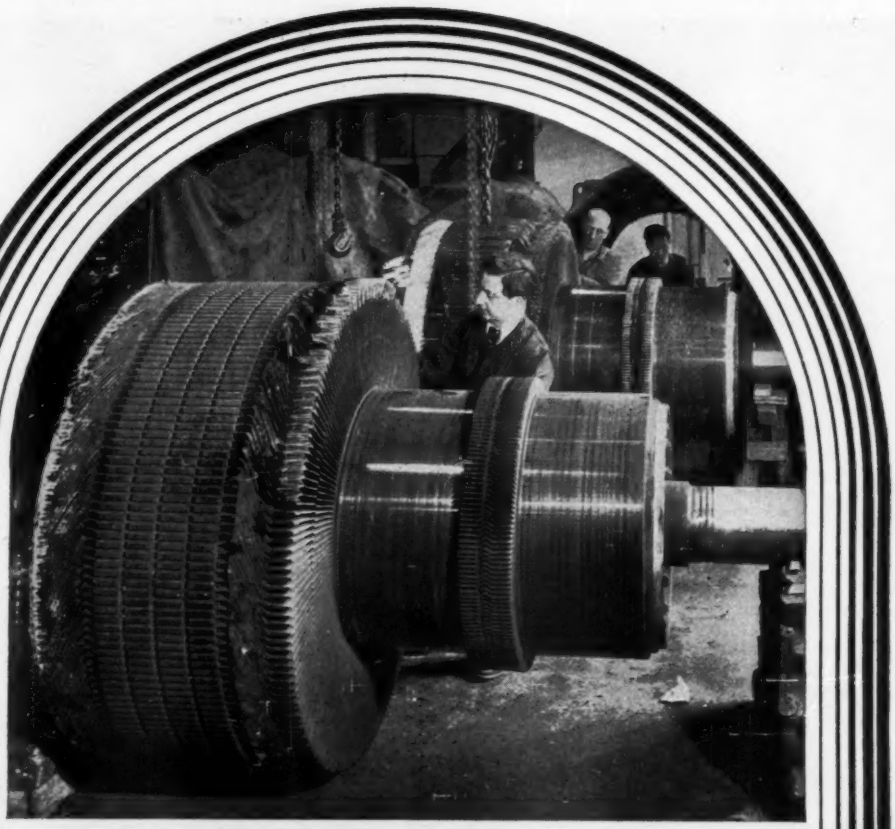

Engineers' Language! For every Plant Engineer who swears at Collins, there are ninety-eight and a quarter who swear by them. Engineers being engineers, this is quite something. As we were saying, we show two 1500kW 240-volt 600 r.p.m. D.C. Generators, one being stripped out for rewinding, t'other being rewound.

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The odd thing is that, with the best will in the world, the chef cannot tell you what he does that makes the difference. It is even more odd that something similar can happen with an engineering company that has been in business for a long time. This is because the solutions to many of the problems that arise in the translation of a specification into an actual length of cable are supplied by the experience you cannot find in textbooks. This is why, even in these days of standardisation, a name with a long history still counts for something.

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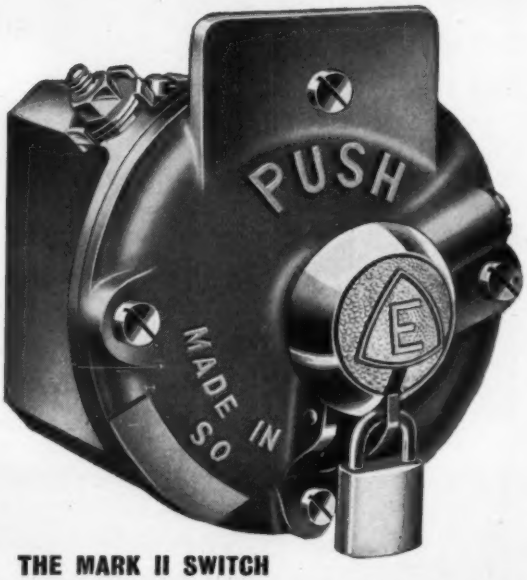
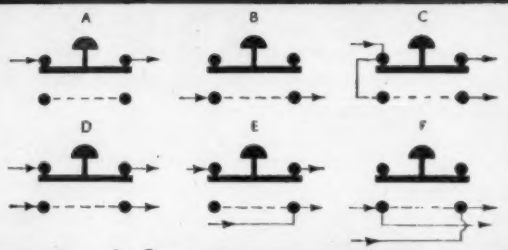
Write for List No. 11 for details of "Ellison" trip switches and tappet operated limit switches for up to 150 amps.



THE MARK II SWITCH

The contacts provide two single-pole, double-break switches that can be used for independent circuits or linked to give a single-pole, two-way combination. The diagrams below show alternative methods of wiring as follows:—

A. Normally "closed".
B. Normally "open".
C. Single-pole, two way, which may be used for a ringing key.
D. Two independent switches, one normally "closed" and one normally "open". Also may be used for a ringing key.
E. Normally "closed" with loop terminals as for series connected under-voltage release circuits.
F. Normally "open" with loop terminals as for parallel-connected shunt trip circuits.



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A/52

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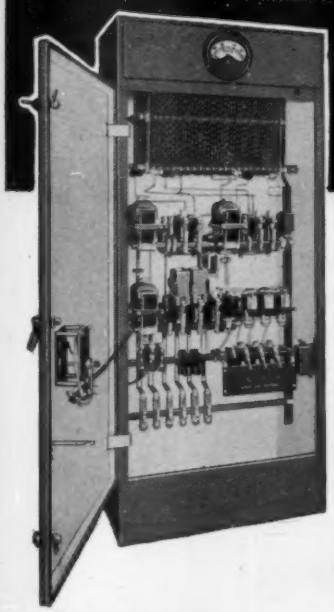

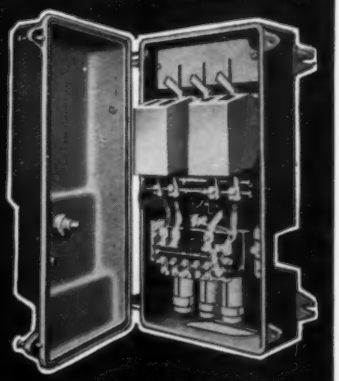

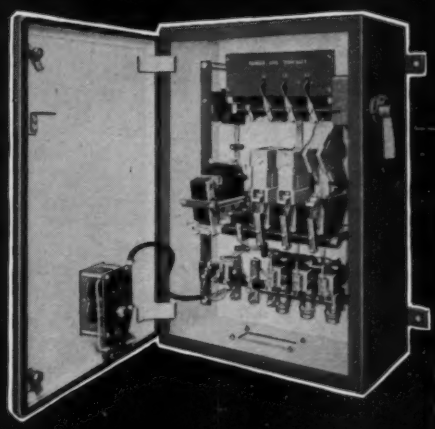

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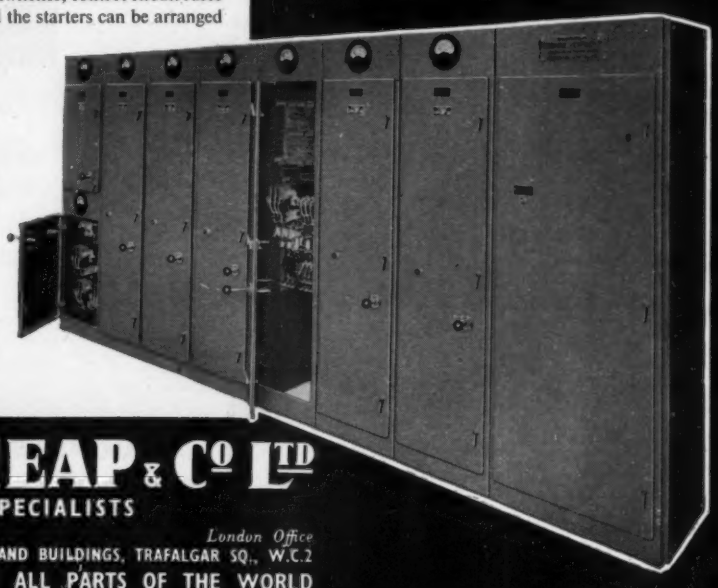
The multi-motor panel type Switchboard illustrated (right) is one of many supplied to one of the leading petroleum companies.



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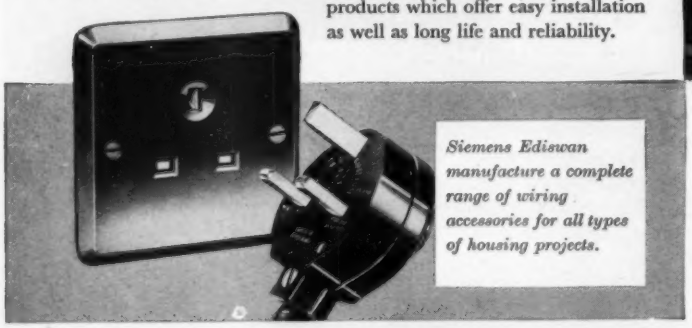

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18/2/TAB 1121

31 JANUARY 1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

Export Prospects	185	Despite difficulties, world demands for electrical equipment must continue to expand and British manufacturers are able to meet them
New Challenges to Electrical Exporters	187	The chairman of the B.E.A.M.A. Council speaks for manufacturers in stressing their ability to maintain and increase their contribution to world export trade
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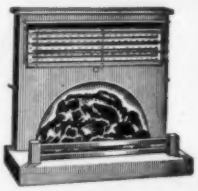

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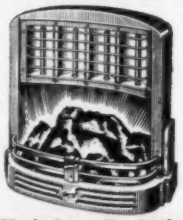

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Export Prospects

IT is axiomatic that export trade is much more difficult to secure and transact than home sales and it is greatly to the credit of the electrical industry that it has achieved so much in overseas markets. The credit is well spread over the industry but there are still many concerns whose products might find acceptance who have not yet gone into the export business. As our national economy depends so much on earning foreign currency it is in everybody's ultimate interest that export trade should be increased wherever possible.

This annual export issue is designed to show the extent of electrical business throughout the world and to demonstrate to overseas buyers the ability of British electrical manufacturers to meet all demands. This is not mere boasting: the record of the past twelve years, since the end of the war, is there to prove it and the account of contracts carried out in 1957 which appears in this issue shows that the pace is being maintained. In another article the achievements of British manufacturers in the realm of power generation are surveyed as further evidence of their progressive outlook and technical competence.

Critics, both at home and abroad, often accuse British industrialists of indifference to the needs of overseas buyers. The obvious answer, so far as the electrical manufacturers are concerned, is to point to the continued growth of export business. This is not to say that everything is perfect, but it is more and more true that British industrialists are studying their markets and adapting themselves to the requirements.

Export trade to-day is hedged about with difficulties—it always has been. Protective tariffs, quota systems and even total exclusion are hazards that have to be met. At the present time international trade is threatened by the fall in commodity prices which reduces the purchasing ability of primary producing countries. Conditions in the United States, which are reflected around the world, are uncertain. These handicaps are recognised by Mr. J. O. Knowles, chairman of the B.E.A.M.A. Council, in a contribution specially written for this issue, but he expresses his conviction that the electrical industry is better equipped to face the future than ever before, and that its efficiency continues to rise.

There can be no doubt that even if competition is increasing the general trend of world trade must be upward and there should be scope for all suppliers. Many nations are striving to raise their living standards and in their endeavours they need the help of

the more advanced countries. Others who are already on a higher plane are turning more and more to electrical methods and look to countries like Great Britain to provide technical assistance and equipment. There seems to be unlimited scope and if we produce goods at economic prices we must continue to enjoy an increasing share of world electrical trade.

CONTROLLING FUSION REACTION

The announcement by the United Kingdom Atomic Energy Authority concerning the progress which has been made at Harwell in investigations into the possibility of establishing controlled thermonuclear reactions in deuterium represents a major step forward in what is likely to be the most important scientific development of the century. There has been a lot of loose talk about " power from the sea " and so forth, with hints that we shall soon have unlimited power at our disposal. It must be emphasised that the present work is only a part of what may well be a 20-year programme of development before practical large scale generating plant can be constructed.

It is not yet known which way developments will go, but there seem to be two ways of getting electrical power from deuterium fusion. One would be to use the heat generated by the fusion to raise steam to drive the conventional generating plant. There is also a distinct possibility that apparatus similar to " ZETA " could be used to produce electricity directly and this would be ideal since the efficiency of the apparatus would be fairly high. It must not be thought, however, that this would lead to very much cheaper electricity since 75 per cent of the present cost to the consumer is accounted for by transmission and distribution.

OPPORTUNITIES IN CANADA

Canada remains the world's largest importer of electrical goods, most of which are supplied by the United States. Yet, as the recent Trade Mission showed on its visit, Canada is most anxious to buy from Great Britain and the members of the Mission are continuing their activities. It is announced from Ottawa that it is proposed to set up a Canada-United Kingdom Trade Council under the chairmanship of Mr. J. S. Duncan, of the Hydro-Electric Power Commission of Ontario, deputy leader of the Mission. The purpose of the Council will be to encourage British trade with Canada by telling British business men how they can secure orders.

The Council will, of course, be concerned with trade generally but, with an electrical man at its head, it is fair to assume that electrical trade will be prominent in its activities.

GENERATION SURVEY

As we advanced with the work of preparing for this special issue the survey of generation in this country over the past ten years or so, we saw the necessity more and more of delving into the past where we found roots of current developments back into the years between the two wars—for instance, the earlier re-heating schemes, very much more than ten years ago, such as that at Dunston, and the 100 MW turbo-alternator sets at Battersea which were installed before the last war, and so on.

But what is more curious, however, is not the fact that developments were resuscitated in the post-war programme so much as the fact that no one in authority now appears to know very much about why the original developments took place. The explanation of this no doubt is that whereas in the earlier days many individual engineers were free to exercise their own pioneering spirit according to their own particular ideas, nowadays things are directed in a more ordered way by a central authority. We feel that in the survey we have shown how both the earlier individualist and the co-ordinated group have contributed magnificently to the great advance in the past few years.

CO-ORDINATION

Our leading article of 17th January commented on proposals made by Mr. W. B. McArthur for co-ordination of the fuel and power industries. We expressed our antipathy to the general idea, believing that any co-ordination scheme would operate to the detriment of electricity supply. In this issue Mr. McArthur replies to our criticisms and quotes the names of four Members of Parliament as evidence that not all co-ordination suggestions come from the gas industry; we said " practically all."

We are still convinced that any attempt to run the coal, gas and electricity industries together would be injurious to the public interest. Instead of each standing on its own feet and being obliged to pay its way, or be shown not to be doing so, there would be a " swings and roundabouts " arrangement by which losses of the coal industry, say, would be covered up by surpluses from electricity supply. Some people may consider this to be reasonable but we do not. As to co-ordination on the fringes of the industry—combined billing, showrooms, etc.—we doubt whether most of it would be workable or whether the savings would be really significant. But such co-ordination might be the thin end of a wedge.

INDUSTRIAL MEASUREMENTS

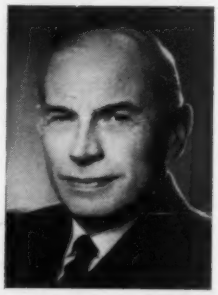
One result of the present intensified striving after productive efficiency is the great increase in the number of electrical metering devices used in industry and, equally important, the more serious attention usually paid to their indications and to the implications to be derived from them by skilled people. The survey of modern instrument design given in Dr. G. H. Tagg's I.E.E. lecture (summarised last week) provides evidence of the notable response of their makers to the demand for complex designs of an exactitude in performance not generally realisable at one time, in which the desirable feature of small size has not militated against legibility or reliability.

The value of electrical instruments in facilitating the splitting up of costs between different departments of a factory was among the earlier recognised merits of their use on an extensive scale. An important later departure from the old tendency to regard their readings as mainly of historic interest has been their use in providing immediate indications of matters that call for, or even initiate, corrective action.

New Challenges to Electrical Exporters

BRITISH MANUFACTURERS CONFIDENT OF FUTURE PROSPECTS

By J. O. KNOWLES, M.A., M.I.E.E.*



THE pace of development in the electrical and allied engineering industries has been very rapid in recent years, both in the design of the equipment manufactured, and in the organisation of its production and marketing. The advance of scientific research and its application to practical use has exerted a continual pressure on management and staff to improve manufacturing techniques to take advantage of the latest knowledge. The key position which the electrical industry occupies in the national economy by virtue of its place as one of Britain's largest exporting industries has brought also a greater awareness of its economic and technological progress, which the industry is making every effort to increase, in spite of many limitations on its trading activities both at home and abroad.

Review of 1957

The industry's performance last year fully maintained the record achievements of 1956. It is too soon after the end of the year to be precise as to the exact figures, but there is sufficient information to show that the total value of production of electrical goods is now about £1,300 million a year. Total exports for 1957 are estimated at £279·1 million as compared with £272·5 million for 1956. Important extensions to the industry's production capacity were completed during the year, which will add significantly to the ability of British electrical manufacturers to meet the demands of home and overseas markets. Millions of pounds have been invested in new plant and machinery and in the provision of extra factory space in the past two or three years.

More workers are employed in the industry than ever before. The *Ministry of Labour Gazette* gave the record figure of employment in electrical manufacturing of 721,800 in October, 1957, as against 521,500 in June, 1948. This industry has been one of the strongest supporters of higher standards for technological and technician training, of industry-based sandwich schemes, of new City and Guilds courses for technicians, and of day release for apprentices. Practical training in works training schools, on the shop floor and in the offices, has been integrated with technical school, college and university training to provide still more craftsmen, technicians and technologists in the industry. Such training in British engineering concerns is much sought after and it has become difficult to satisfy all requests from students from abroad. In addition, the home demand for training has become so great that co-operative schemes of specialist manufacturers have been organised in several centres of electrical manufacture to provide additional training facilities and " cross-fertilisation."

Progress of Electrical Exports

The year 1957 again witnessed the winning of large overseas orders against very keen foreign competition. Over the past four years over £1,000 million of electrical plant, machinery and equipment has been exported from Britain.

The record achievements of the electrical industry in overseas markets are not only due to the efforts of the giant firms and groups in the industry. Firms of all sizes have contributed to the result, either by independent action or as sub-contractors, and though individual contributions may seem at times to be small, they have added not only to the industry's total, but have also assisted the export of other British machinery and products not included in the total of electrical exports.

The increase of 2½ per cent in electrical exports for 1957 over 1956 is an important achievement when the reduced margins on export contracts and the severe foreign competition which has had to be faced are taken into account.

There was little change last year in the relative contributions to the year's total made by the various sections of the industry. Electrical machinery, radio and telecommunications, cables and domestic appliances maintained roughly the relative positions of previous years. Increases in exports of some items in the general classification of electrical machinery were substantial, although, as might be expected, exports of some domestic appliances were not as high as in former years. Electronic equipment, telegraph and telephone apparatus, and electric cables also recorded advances on their 1956 totals.

The most outstanding trend in the 1957 pattern of exports was the increase in sales to the United States, particularly in the export of wires and cables. The United States and Canada are now substantial markets for British electrical goods. In 1957 £27 million worth were sold there, which compares with the £23 million exported to India and with £23 million to Australia in the same period. It is also gratifying to note further progress in other dollar markets, notably in Venezuela. Trade with Western European countries was about 19 per cent of the total exports, the Netherlands and Sweden being the largest customers. British electrical manufacturers are examining very closely their trading relationships with Western European countries in the light of the Government's proposals for association with the European Common Market in a Free Trade Area.

European Free Trade Area

As is generally known, these proposals envisage the progressive reduction of tariffs on manufactured goods exchanged between certain European countries over a period of from 12 to 15 years at the same rate as that agreed in the Common Market plans of Germany, France, Italy, Belgium, the Netherlands and Luxembourg.

The proposals are far-reaching and, if carried out, will have a profound effect on British industry. Many discussions have already taken place here at all levels in an

* Chairman of the Council of the British Electrical and Allied Manufacturers' Association.

endeavour to assess the outcome more precisely. Many British manufacturers, for example, have expressed concern about the effectiveness of the rules and safeguards governing the fair trading conditions of the Area in view of practical difficulties in their enforcement.

It is important to realise that the elimination of tariffs is only the shadow of the substance of the real aim of these negotiations. The chief aim is to increase the political and economic strength of Western Europe. Safeguards are more likely to be effective in establishing fair trading conditions if there is, at the same time, an overriding determination to reach a common objective.

The primary objectives of the six countries are political as well as economic. They did not negotiate the Common Market Agreement simply to compete with each other more effectively, but in order to strengthen each other by more effective co-operation. The standardisation and simplification of users' requirements are more effective in reducing costs than cut-throat competition.

Competitive Position in Europe

A recent survey of the probable impact of the Free Trade proposals on British industries points out that the British and German electrical industries are far ahead of other European countries in the size and range of their outputs, with the French industry a strong contender, and the smaller European industries highly competitive in certain specialised products.

From an examination of manufacturing costs, it is estimated that, as regards Britain and Germany, the advantage has been with the British in cost of materials and with the Germans in cost of labour, but that both derive benefit where they have the economy of large-scale production. No real indication has emerged to show that either country has, in general, any important advantage over the other in overall costs.

It would seem, therefore, that such objectives as our industries have in common with the Continental industries are rather to quicken the pace of our increasing efficiency by the use of each other's experience than to " take in one another's washing," as, for instance, by building each other's power stations.

We should be well advised not to regard the elimination of tariffs as the only aim of negotiation. Without supporting measures of co-operation, the abolition of tariffs is not likely to result in an acceptable conclusion to such negotiations. The British electrical industry will no doubt require to strengthen some of its links with similar industries in the industrial countries of Western Europe, to discuss with them more freely technical and development problems, and to arrange mutual licensing agreements.

The British electrical industry, as always, is very alive to the needs of the Commonwealth territories, which for many years have taken over half of the industry's exports. Any opportunities in the Free Trade Area will not be taken by our industry at the expense of meeting the requirements of British countries overseas.

Nuclear Power Development

Possibly the greatest hopes in new export possibilities are fixed on our leading position in nuclear power development. Electrical concerns are foremost in the organisations which are making plant and equipment for nuclear power stations, and many other firms in the scientific and electrical instrument business have also won international recognition for the quality and reliability of their products in this new field.

The Government's nuclear power programme is of great importance to the industry, since it provides such a striking advertisement of the industry's technological progress, and it is to be hoped that the capital investment programme will not postpone the completion of any such project for a month longer than is necessary.

The many firms in the nuclear field have been very active in export markets, and it is gratifying that the first contract for a complete nuclear power station to be exported has been given to British manufacturers. It is difficult to foresee precisely the size of the contribution such exports will make to Britain's foreign exchange earnings, although as our own programme of nuclear power stations advances and still more experience is gained from their actual operation, manufacturers will be even better placed to meet foreign requirements. Research in this section of British industry has the highest priority and electrical manufacturers are expanding considerable resources in this direction.

Outlook for 1958

Most people would agree that the long-term prospect for the industry is very bright. The rise in world population, the desire for improved standards of living and the growth in energy consumption all over the world signal ever-greater opportunities for British manufacturers. The immediate prospect, however, calls for an intensification of effort, although many order books are still full. Heavy plant manufacturers have secured spectacular overseas orders in recent months, but the effect of a halt in expansion of the home electricity supply programme has still to be assessed.

Success in the measures taken to defend the pound and a relaxation of the financial squeeze would encourage capital investment in other industries and increase the demand for intermediate ranges of electrical equipment.

It would also seem probable that the recent upturn in the sales of some domestic appliances should continue, barring any drastic drop in employment and earnings. Expanding production in this field would undoubtedly help the competitiveness of the products abroad, because of the advantages of large-scale production.

The decline in world prices of raw materials is of particular concern to electrical exporters since many of the industry's largest customers in the Commonwealth will have to conserve their financial resources. New Zealand has thought it prudent to impose sharp cuts in imports into that country, including electrical products. Past experience encourages the belief that these cuts will be restored in some measure as soon as the crisis has passed. The visit of the Canadian Trade Mission coincided with a pause in Canadian economic growth, but this in no way discourages us from striving to increase our exports to that country.

Financial considerations also hamper ambitious projects in many other countries in which British exporters may expect to play a part. Demands for capital projects grow all over the world in spite of their development being handicapped by lack of funds.

Another major factor in the present uncertain state of the world's economy is the absence of any real upturn of business activity in the United States, with all the repercussions that any further decline might have on the scale of world trade.

World markets in 1958 are therefore expected to be more competitive. But the British electrical manufacturing industry is also highly competitive. It is better equipped to face the future than ever before and its efficiency is improving all the time. Provided that inflation is held in check and that overseas purchasers can be adequately financed, the industry will continue its outstanding contribution to the country's exports.

British Electrical Equipment Overseas

BACKGROUND TO THE 1957 EXPORT FIGURES

ALTHOUGH the figures of electrical exports in 1957 reproduced on page 211 bear testimony to the ability of British manufacturers to supply to all parts of the world virtually every type of electrical machinery, equipment and apparatus, they give no idea of the wide variety of technical design called for, nor of the range of uses to which equipment is put and the conditions under which it operates. To fill in this background we give below some typical examples—ranging from turbo-alternators to lighting fittings and washing machines—of equipment that was exported or commissioned during 1957.

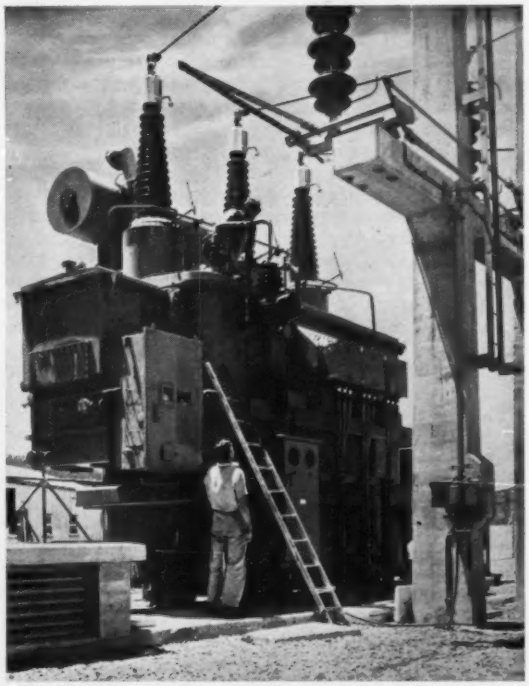
Emphasis naturally falls on the larger contracts for the more spectacular items of plant, but these should not be allowed to detract from the important contribution to the total figure of the great bulk of smaller and often standard equipment which, although its final destination and use may be unknown, plays a nonetheless significant part in maintaining the prestige of the British electrical industry overseas.

A notable overseas installation carried out by the British Thomson-Houston Co., Ltd., comprised the two 66,667 kVA, 150 r.p.m. water-wheel generators and their associated transformers at the Eildon power station of the State Electricity Commission of Victoria, Australia. The generators are mounted above floor level and driven by Francis turbines. The seven 11/225 kV single-phase generator transformers are arranged in two 67·5 MVA banks with one spare unit. At Owen Falls the seventh and eighth 16,500 kVA, 150 r.p.m. water-wheel generators are being erected and they should be commissioned this year. The two 110 kV, 30 MVA, three-phase transformers installed at the Umtali receiving station, Southern Rhodesia, form part of the transmission system that supplies power to the eastern districts from the new Revue hydro-electric power station in Portuguese East Africa.

At Baie Comeau, near Quebec, eight of the sixteen rectifier transformers ordered were commissioned at the new aluminium smelter of the Canadian British Aluminium Co., Ltd. The transformers, which are rated for a rectifier output of 12,100 kW, 850 V d.c., are probably the largest in the world for this duty. Other overseas installations completed include a number of transformers with voltage ratios of 66/11 kV and ratings from 10 to 18·75 MVA for various customers in India, two 61/10 kV, 10 MVA transformers in East Africa, and two 66/11 kV, 2·5 MVA transformers in Nigeria.

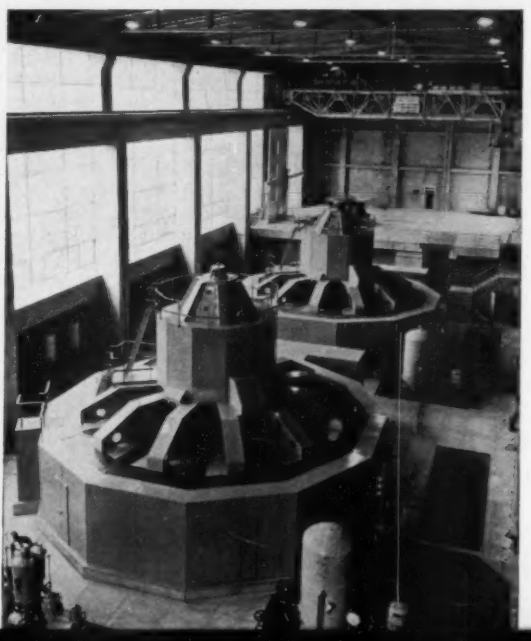
The 26 three-phase reactor tiers, rated at 10 kV, 5 per cent on 6 MVA, that were supplied to Holland have the incoming and outgoing connections supported from the reactors to suit Dutch practice and they were given a black-japan anti-corrosion finish. The reactors are capable of carrying a maximum r.m.s. overcurrent of 6,000 A for 5 sec, and an asymmetrical current of 15,700 A. A further order for Holland completed during the year covered twelve three-phase reactor tiers rated at 3 kV, 6·06 per cent on 3·12 MVA. These are of similar construction to those above but, in addition, the winding is insulated with asbestos braiding as an added protection against vermin.

The mercury-arc rectifier equipment for the first pot



A 35 MVA, 132 kV, B.T.H. transformer being installed at Wallerawang power station, New South Wales

Eildon power station, Victoria, Australia, showing the two B.T.H. 66,667 kVA water-wheel generators



line at the Baie Comeau aluminium smelting plant (see above), together with the alternative 33 kV supply busbar system, central control room and auxiliary services was erected and successfully commissioned. Erection of the rectifier equipment to supply the second 850 V, 100,000 A pot line is now in progress and it is expected to be in service in the second half of this year. Also commissioned during the year were the first 3,000 V mercury-arc rectifier units for the Calcutta railway electrification, and a 13,000 A, 150 V germanium rectifier unit for the electrolytic refining of copper in Rhodesia.

Switchgear, transformers and rotating machinery were supplied by the Brush Electrical Engineering Co., Ltd., to various Government and industrial concerns in many countries. Among the more noteworthy contracts completed were those for two 33 kV bulk-oil circuit-breakers for the United States Bureau of Reclamation, h.v. switchboards comprising 48 panels for the Tata power station at Jamshedpur, India, ten 6·6 kV panels for the Flamenco substation in Rio de Janeiro, and seven panels of the same voltage for Benghazi power station and ten for Mauritius.

Further orders for turbines were received from Mauritius and a 1,000 kW back-pressure set was commissioned on one of the sugar estates. In Nigeria the second 12·5 MW Ljungstrom steam turbine was commissioned at Ijora "B" station, Lagos, and at Wide Bay, Australia, the third 15 MW Ljungstrom set was brought into operation. A further order for this station is in hand.

The General Engineering Division, which co-ordinates the products of other divisions and associated companies in dealing with comprehensive contracts, supplied and erected equipment for several major schemes including the two 3 MW Ljungstrom turbines, 4,500 lb/hr John Thompson boilers and all the switchgear and ancillary equipment for the Chopan power station, India. Other stations utilising diesel engine driven alternators were commissioned in Ceylon, Saudi Arabia, Baghdad, the Lebanon and Australia, and the company's "Square Path" alternators were shipped in increased numbers for coupling to engines of various manufacture.

Deliveries of motors included eight of 1,150 h.p. for the Associated Cement Co. for India, and seven of 1,380 h.p. and four of 1,460 h.p. for Australia. Forty transformers, ranging from 2,500 kVA to 40 MVA, were shipped to South Africa. Two 12·5 MVA and one 5,000 kVA transformers were supplied to Brazil and two 1,500 kVA units to the British Columbia Power Commission in Vancouver.

Transformers for the United States

Several large contracts for power transformers and h.v. test equipment of special technical interest were completed by Ferranti, Ltd., last year, in addition to orders for equipment of standard type and construction. The company's success in selling to the United States is represented by two 189,000 kVA, 13·2/230 kV, three-phase banks of generator transformers, and one 189,000 kVA, 13·2/115 kV three-phase bank of generator transformers for the U.S. Army Corps of Engineers' Dalles Dam project; and one 80,000 kVA, 154/69/13·2 kV three-phase bank of transformers and a spare unit for the Pigeon Forge substation of the Tennessee Valley Authority. Five 60 MVA, 132/33 kV three-phase transformers have also been supplied to the Electricity Commission of New South Wales, and three 30 MVA, 5/111 kV three-phase transformers went to the Andhra Valley Power Co., India.

The h.v. test equipments included a 800 kV impulse generator, surge potentiometer and oscillograph for the Reliance Electric & Engineering Co. (Canada), Ltd., Ontario; the third 300 kV, 600 kVA transformer and reactor unit for Standard Telefon og Kabelfabrik, Oslo, to increase the capacity of the testing plant to 900 kV, 1,800 kVA; a 330 kV, 750 kVA transformer and associated control equipment for Felten & Guilleaume, Vienna; a 150 kV d.c. testing equipment for the State Oil Fields, Argentina; and a 250 kV a.c. testing equipment, 250 mm sphere gap, 40 kV d.c. testing equipment and a 50 kV oil testing set for the College of Engineering, Trivandrum, India.

The wide activities of the General Electric Co., Ltd., are reflected in the overseas orders which the company completed during the year. Among the generating plant commissioned was a 1,750 kW alternator, supplied to the Lake View and Star Mining Company of Western Australia, which is coupled to a 3,050 b.h.p. Crossley-Premier oil engine. The alternator is of the salient pole type, and generates at 3·3 kV, 0·8 power factor, 40 c/s when driven at 218 r.p.m. The third 10 MW, 11 kV turbo-alternator was also commissioned at the new power station at Bloemfontein, South Africa, for which the G.E.C. has supplied all the associated 11 kV switchgear with control and relay boards, bus zone protection equipment, and three oil-immersed reactors. Two 30 MW sets were commissioned at the Kelvin power station, Johannesburg.

Colliery Winders

A 1,450 h.p. winder with a single drum, 14ft in diameter by 10ft 6in wide, was installed at Cessnock Colliery, New South Wales, for raising coal from a depth of 1,270ft. The drum shell is of welded construction. The winder, commissioned at Mount Isa, is claimed to be the largest yet installed at an Australian mine. This 16ft diameter by 6ft double-drum, double-clutched winder, driven by two 2,250 h.p. d.c. motors, is designed to deliver 180,000 tons of ore from mine to mill each 28-day period. The installation incorporates automatic push-button control from 12 levels. Electrical equipment supplied for a four-rope Koepe winder installed at the Driefontein gold mine, near Johannesburg, included two 2,050 h.p. d.c. motors and a 3,800 h.p. Ward-Leonard set operating in conjunction with control exciters.

Further sections of centralised traffic control were put into operation on the Bulawayo-Livingstone main line of the Rhodesia Railways between Gwaai and Wankie. The c.t.c. apparatus, which was supplied by the Siemens and General Electric Railway Signal Co., Ltd., provides for the remote operation of signals and points over distances of more than 100 miles.

Witton-James, Ltd., a G.E.C. subsidiary, supplied a complete driving equipment and "Autopaster" reelstands for the Copenhagen newspaper, *Berlingske Tidende*. Printing units and folders are driven by 65 h.p. d.c. motors, supplied through mercury-arc rectifiers with grid control utilising magnetic amplifiers. The "Autopaster" reelstands incorporate electronic control of the automatic reel-changing sequence, and pneumatic control of web tension.

Exports to the United States of valves made by the M.O. Valve Co. for high-fidelity sound reproduction equipment are steadily increasing, and in the 12 months to 31st March, 1957, totalled some 110,000 including about 100,000 of the KT66 type. The larger output KT88 valve, introduced to the American market last year, is already finding substantial sales there. Several hundred communications receivers were supplied to governments overseas for use by their armed forces, and the dollar contracts recently completed and awarded amount to some $9 million. Other military contracts completed overseas included the supply of considerable quantities of specialised audio equipment for naval installations, aircraft

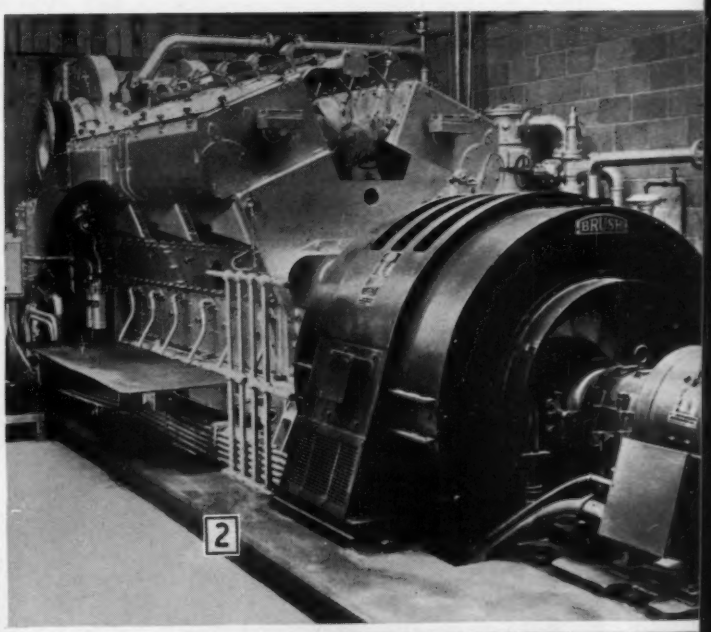
navigational apparatus, and equipment for remote control of high-speed pilotless aircraft.

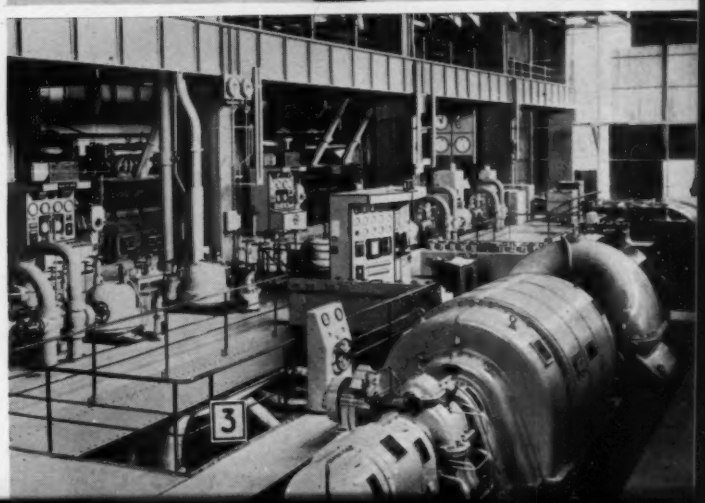
Floodlighting installations for railway yards, football stadiums and public buildings were carried out in many countries, as were street lighting systems using mercury, sodium, tungsten and fluorescent lanterns. In connection with the modernisation of Rangoon airport the G.E.C. supplied runway and taxiway lighting; a distribution system including a main and three minor substations; 1,072 lighting fittings; 265 socket outlets; kitchen equipment; goods lifts; public address equipment; apron floodlights and distribution boards for the passenger and freight handling sheds; and four 75 h.p. slip-ring motors and starters for the main compressors of the air conditioning plant and smaller motors for blower fans throughout the building.

A fully automatic G.E.C.-Fielding radio-frequency machine for making up panels from wood strips was supplied to Russia, and five Express passenger lifts, with an electronic traffic control system, moving 33,000 people a day, were installed in the second section of the New Alexandra House building in Hong Kong. Nigeria's new University College Hospital at Ibadan was fully equipped with comprehensive X-ray facilities by Watson & Sons (Electro-Medical), Ltd., and included in the £41,000 of aircraft galley equipment, cabin lighting and call systems supplied to major airlines all over the world, was equipment worth $55,767 for United States airlines, and other items worth £3,000 for Russia.

The installation of the last of the eight 60 MW turbo-alternators in the Taaibos power station, which were all manufactured by C. A. Parsons & Co., Ltd., was completed last year. In Australia, Parsons installed 50 MW sets at Lake Macquarie and Yallourn power stations, and 30 MW sets at Port Augusta, Osborne " B," Bunbury and Tennyson. A third 30 MW set was completed at Bulawayo, Southern Rhodesia, a 20 MW set was installed in Trinidad, British West Indies, and a second 12·5 MW set in Baghdad. Outstanding among the orders received for turbo-alternators was that for two 300 MW machines for the Long Branch power station of the Hydro-Electric Power Commission of Ontario.

Transformers for 11 countries are now passing through the shops including two 75 MVA, 13·8/275 kV generator transformers for the Boundary Dam power station, Saskatchewan; and four single-phase units, each of 16,667 kVA, 132/26 kV for Brazil, which will be fitted with off-load tapping and air-blast cooling. Another interest-





(1) A 63 MVA, 13·2/230 kV transformer for the United States being impulse tested at the Ferranti works. (2) A Mirrlees-Brush 1,200 kW diesel generator set in Canada. (3) One of the three 10 MW G.E.C. turbo-alternators in Bloemfontein power station

ing transformer, which is being constructed for Venezuela, is rated at 50 MVA, 66/30 kV and will have air-blast cooling and gas cushion equipment in place of the more usual oil conservation.

During the year the Installation Division of Simplex Electric Co., Ltd., supplied switchgear, conduit and conduit fittings to 92 countries. There was also a steady flow of industrial fittings for use in overseas countries and it is claimed that there is Simplex flameproof equipment in every major oil refinery in the sterling area.

Tungsten, fluorescent and outdoor lighting fittings were supplied by the Benjamin Electric, Ltd., to most parts of the world. At the Highveld power station in South Africa, enclosed area floodlights are used for yard lighting, and at the Jamshedpur steel mill of the Tata Iron & Steel Co., Ltd., in India, the installation includes high bay reflectors, Saaflux R.L.M. reflectors and parabolic angle units. A recent large shipment to Pakistan consisted of flurolier Type B fluorescent fittings, for use with twin 4ft, 40 W tubular lamps, finished in "Crysteel" vitreous enamel and fitted with dustproof clear glass visor covers. The company's fittings are widely used in the oil producing areas of the Middle East and a large quantity of high bay units, R.L.M. fittings and "Duoflux" floodlights were delivered to the Kuwait town power station.

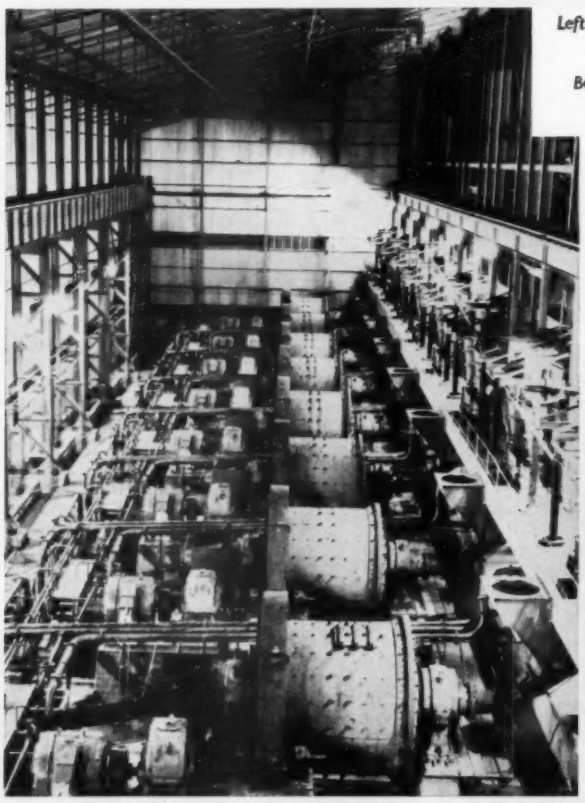
The Lancashire Dynamo Group of companies have continued to develop their position in the world's export markets, and the following examples are an indication of the Group's diverse activities. Among the considerable amount of plant supplied to Canada by Lancashire Dynamo & Crypto through the Group's associated company Bepco Canada, Ltd., was a 1,250 h.p. synchronous motor for the St. Mary's Cement Co., and 75 20 h.p. slip-ring motors for driving lock-operating gear on the St. Lawrence Seaway. Eight 400 h.p. motors were also supplied by this company to Rhodesia for driving a battery of ball mills at the Bancroft copper mine.

Three special automatic voltage regulators with auxiliary motor control equipment were supplied by Foster Transformers for use in a terylene plant in Japan, and J. G. Statter, who supplied the 11 kV, 250 MVA substation switchgear for Malta's electricity distribution scheme, were awarded the contract for the extensions in the islands of Gozo and Comino. Similar equipment was supplied for Cairo International Airport.

The Group provided all the transformers and alternators for the modernisation of the Port of Latakia, Syria, and also the 1,330 kVA diesel-driven alternators, with electronic automatic voltage regulators, for the municipality of Latakia. Among the appreciable amount of work done in South Africa mention may be made of the two "Varionic" variable-speed drives totalling 470 h.p. for wire-drawing machines and a 250 h.p. "Varionic" drive for a cement works.

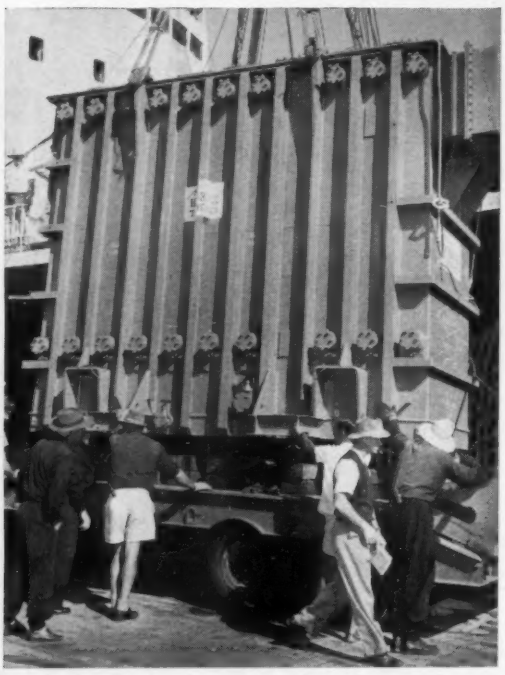
Export orders received by Birlec, Ltd., account for about 10 per cent of the company's production and are continually increasing. During 1957 they included the first orders, worth nearly £1 million, for the mains-frequency coreless induction melting furnace, a crucible furnace similar to the well-known h.f. unit, which Birlec introduced into Britain in 1955. A three-ton furnace rated at 700 kW, for melting and holding iron, was ordered by Anderson's, Ltd., New Zealand, and two similar units rated at 720 kW are to go to Finland.

The largest of three arc melting furnaces on order for India is rated at 2,000 kVA and has a capacity of four



Left: Lancashire Dynamo & Crypto 400 h.p. motors driving a battery of ball mills at the Bancroft mine, Rhodesia

Below: A Hackbridge & Hewittic 15 MVA, 132/69/11 kV three-phase transformer being unloaded at Townsville, Australia



tons. Other direct-arc melting furnaces for steel making include a three-ton unit rated at 1,500 kVA for the Corporation Minera de Bolivia, which is being installed 12,800ft above sea level; a 10 ton, 4,000 kVA unit for Johannesburg; and a 3,000 lb, 800 kVA unit for Portugal.

The camshaft hardening machine which has been sent to the Austin Motor Co. in Australia, hardens, by induction heating, and in one operation, the wearing surfaces of journals, eccentrics and gear cams to a depth of 0·05in and through hardens the gear teeth. It has an output of 1,000 camshafts a week and is intended for use by unskilled operators. Heat treatment furnaces built for overseas firms include three bell furnaces for Metallwerke A.G., Dornach, Switzerland, the contract for which was won against severe Continental competition. Each furnace has three hearths for bright annealing processes and one for vacuum aluminising.

Among the many overseas orders for switchgear and motor control gear which Erskine, Heap & Co. have completed during the year, mention may be made of those for 92 switchboards for the Government of Ceylon, a large pump control board for Tanganyika and a heavy current d.c. switchboard for Lisbon, Portugal.

Railway Electrification

Last year the Metropolitan-Vickers Electrical Co., Ltd., delivered 50 of the train units forming part of a £7 million order for the Central Railway of Brazil; the second part of this contract, involving 50 complete motor coaches and 100 sets of trailers, is now in hand. Some of the forty 3,820 h.p. electric locomotives on order for the New South Wales Government were also put into service.

The first two 33 MW steam turbo-alternator sets for the Manitoba Hydro-Electric Board were installed at the Brandon power station and a 30 MW set for the Saskatchewan Power Corporation was commissioned at Estevan. A 3,200 kW double pass-out geared turbo-generator, with auxiliary equipment, including condenser, feed heaters and de-aerator is now being installed for the Kasham Spinning Co., Iran, and the associated switchgear and transformers were also supplied.

The first three of four 12 MVA transformers for the Compania Argentina de Electricidade were shipped. In Colombia distribution transformer business continued satisfactorily despite severe competition, orders being executed for 110 distribution transformers for the company's agents, together with 52 larger transformers for Centrales Electricas del Norte de Santander. The supply of 25 squirrel-cage motors and associated control gear for the Pointe-a-Pierre refinery of the Trinoil Co., Trinidad, is now almost complete, and installation proceeded of the motors, valued at around £250,000, supplied to the Kuwait refinery. In New Zealand, a 4 MeV linear accelerator was installed for the Auckland Hospital Board.

British Insulated Callender's Cables, Ltd., made a major contribution to the electrification of the main line between Parramatta, near Sydney, and Lithgow in the Blue Mountains—a distance of 83 miles—when they designed, supplied and installed the overhead equipment in accordance with the contract awarded by the Department of Railways, New South Wales. The line was officially opened in June, 1957. The equipment is supported in the main from portal structures fabricated in England from some 7,000 tons of steel.

In April last year the switching-in of Asia's first 100 kV impregnated pressure cable installation took place in Bombay. The two three-core cables, each capable of carrying up to 90 MVA, were supplied by B.I.C.C. and laid by them through 4½ miles of congested streets in the port area. Because of the high temperature and humidity, jointing had to be carried out in tents within which the atmosphere was controlled.

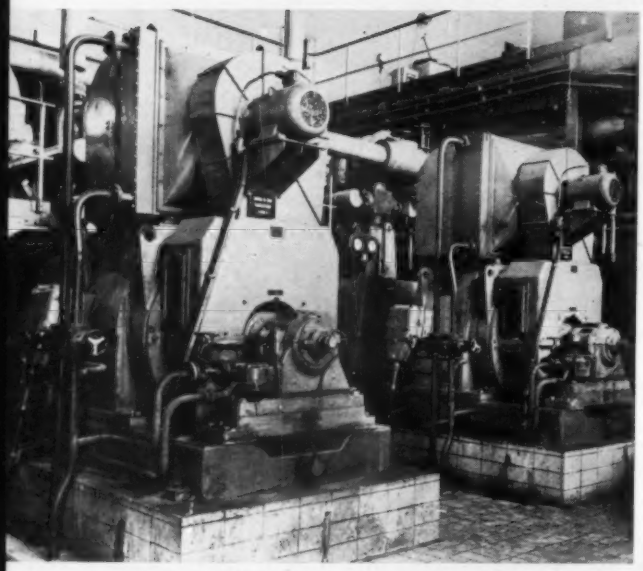
Passenger train drawn by a 3,820 h.p. Met-Vick locomotive in the Blue Mountains, Australia. The overhead equipment was designed and installed by B.I.C.C.

Some 21,000 yd of 33 kV ductless, shaped-conductor, oil-filled, three-core cable (D.S.O.) with aluminium conductors and sheath was supplied and installed for the City of Bloemfontein Electricity Department. Other contracts for h.v. cable completed during the year were for Kuwait, Sudan, Athens and Brazil.

A second order was received from the British Columbia Electric Co., valued at $3,500,000, for an additional circuit in the 138 kV submarine cable link between Vancouver Island and the mainland.

B.I.C.C. also manufactured and supplied the capacitors, the copper connectors and supporting insulators and steelwork, for the series capacitor installation that the Electricity Supply Commission of Southern Rhodesia have installed in their 88 kV, 90 mile long, transmission line between Umniati and Norton. This enables the capacity of the line to be increased by 100 per cent. At full-load current the total output of the capacitors is 6,000 kVAr and the voltage across each of the three sections of capacitors is 10 kV. In Queensland, Australia, B.I.C.C. have undertaken the erection of over 500 miles of overhead lines from 55 kV transmission to low-voltage distribution and have supplied much of the material used in the installation. The work which has been in progress since 1952 is now nearly complete.

Deliveries to New Zealand and South Africa figured largely in the export activities of Ferguson Pailin, Ltd., during 1957. Type VTB5 duplicate busbar units for 11 kV, 350 MVA service in the Brighton substation, and also control room equipment, were supplied to the Christchurch Municipal Electricity Department. An order for 42 triple-tank indoor cellular circuit-breakers for 40 kV, 1,000 MVA service was received from the South African Electricity Supply Commission to supplement the 36 similar circuit-breakers at present being supplied under a previous order. A quantity of Type ROP32 single-bank outdoor circuit-breakers of 33 kV, 750 MVA rating, was supplied to the Madras Electricity Department for their Basin Bridge substation. Switchboards of single and duplicate busbar design rated at 11 kV, 350 and 500 MVA, were commissioned in Kuwait in connection with the extension of the country's main distribution system. Further large orders for 11 kV switchgear included two contracts for over 120 units for the Government of Ceylon, comprising 250 MVA single-busbar equipment for substations in the Southern Ring and in Colombo.



Variable-speed Laurence, Scott a.c. motors driving boiler feed pumps at Alost power station, Belgium

The first batch of 180 kV porcelain bushing insulators was supplied by Doulton Industrial Porcelains, Ltd., to the Canadian General Electric Co., Ltd. Further monthly deliveries are being made over a twelve-months' period and production is now ahead of customer's requirements. Previously, supplies of this porcelain were obtained from the United States.

Not only does EMP Electric, Ltd., export over 70 per cent of its output, but a large part of this goes to the dollar area. Among the installations for which high- and extra-high-voltage lightning arrestors have been provided are the MacNary and Chief Joseph substations on the Bonneville Power Administration's 345 kV systems; the 138 kV systems of the British Columbia Power Commission and Saskatchewan Power Corporation; and the 138 kV and 230 kV systems of the United States Government Department of the Interior. Both distribution and line type arrestors have been supplied to the Hydro-Electric Power Commission of Ontario. The Hydro-Electric Power Commission of Quebec, which are already using these arrestors on their extra-high-voltage system, took further deliveries of 115 kV station arrestors. Station type arrestors were also purchased by the Uganda Electricity Board for use on their 66 kV and 132 kV systems and over 1,000 heavy duty lightning arrestors were supplied for the 1,500 V and 3,000 V d.c. traction installations of the South African, Indian, Spanish and Italian railways, and the Victorian Railways, Australia.

EMP also provided 132 kV lightning arrestors and current limiting h.v. fuses for the portable generating station which was supplied from the United Kingdom to the Damodar Valley Corporation in India. A recent contract was for over 1,000 h.v. current limiting fuses for the State Electricity Commission of Victoria, Australia.

Another small firm that exports around 70 per cent of its output, Gilbert Gilkes & Gordon, Ltd., received orders during 1957 from Chile, Canada, Abyssinia, East and South Africa, India, Malaya and New Guinea. The most important of the water turbines installed by the firm's erection department was the 3,000 h.p. vertical shaft Francis turbine at the Northern Canada Power Commission's Mayo power station in the Yukon, which operates at a head of 110ft. Two Francis turbines, developing 800 h.p. on a 243ft head and 480 h.p. on a 230ft head respectively, were supplied to the Maritime Mining Corporation for Tilt Cove Copper Mine, Newfoundland, and since both machines operate under difficult pipeline conditions, they are fitted with the "Giljet" governing system.

In British Guiana, two 1,100 h.p. low head Francis turbines were started up at the Tumatumari Falls installation of the British Guiana Consolidated Goldfields, Ltd. Other orders completed during the year included a 2,000 h.p. Francis turbine for the Union Electric Light & Power Co., Newfoundland, and two 720 h.p. and one 660 h.p. Francis turbines for L'Office de l'Electrification Rurale, Quebec. A 2,000 h.p., 2,000ft head Pelton wheel has been shipped to the Bolivian Power Co.; and a 1,200 h.p. turbine with "Giljet" governing gear for Iringa power station and a 240 h.p. turbine for Mbeya, have been shipped to the Dar-es-Salaam Electric Supply Co.

Overseas orders now passing through the factory include four medium output units for Mauritius; two of these are 2,850 h.p. Turgo impulse wheels for the Le Val scheme, the others are Francis turbines for the La Ferme and Magenta installations. Other orders include a 3,600 h.p. Francis turbine for the West Coast Power Co.'s Lookout Brook scheme in Newfoundland and three 440 h.p. Pelton wheels for the Robinson Falls scheme in Malaya. Two small units for sheep farms in Chilean Patagonia will probably be the farthest south of all the world's hydro-electric schemes.

In addition to a substantial business in standard equipment, Laurence, Scott & Electromotors, Ltd., completed a number of contracts of particular technical or commercial interest. Most of the motors sent to Australia were for power station auxiliaries, and included two 900 h.p. cooling tower pump motors for Yallourn "E" power station, and four 485/27 h.p. and four 218/13 h.p. N-S variable-speed motors for the induced and forced draught fans at Wallerawang. Among the motors for other duties were four 1,600 h.p. "Trislot" high-torque low-current squirrel-cage motors for a pumping station, which run at 490 r.p.m. and are water cooled; a 700 h.p. N-S variable-speed motor, arranged for reversing and inching in both directions, for driving a cable belt conveyor; and a batch of 40/40 d.c. motors for wire-drawing machines.

In Canada, where the appointment of an L.S.E.-trained

A 180 kV porcelain bushing insulator for the Canadian G.E. Co. being ground to dimensional tolerances at the Royal Doulton works, Tamworth

executive a year or two ago is now stated to be bringing results, motors up to 1,250 h.p. are being supplied for power stations, and other large orders were for slip-ring motors to the requirements of the Canadian Standards Association Class 2, groups F and G hazards. Orders were also received from American oil companies, and variable-speed motors from 5 to 900 h.p. with automatic-control equipment were supplied to a number of countries for use in plant for the production of man-made fibres and synthetic materials. Electric cargo winches and other marine auxiliaries were supplied to European, particularly Dutch, shipbuilders. The manufacture of L.S.E. designs under licence in several countries, including the United States, provides a valuable invisible export.

Newman Industries, Ltd., who claim to be the largest British exporters of electric motors to the United States and Canada, were particularly successful in selling their N.E.M.A. explosion-proof motor, which is believed to be the only motor manufactured outside these two countries to conform to the rigid standards of the Underwriters' Laboratories of America. The order for 30 vertical hollow-shaft motors for the Central Trust of China in Formosa, which was financed by the United States under its foreign aid programme, was secured by Newman Industries against world-wide competition, including several American manufacturers who specialise in the production of this type of motor. The order, worth $13,000, was for 21 40 h.p., seven 30 h.p. and two 50 h.p. motors, which will be used for deep-well pumping in a new system of irrigation designed to help the cultivation of rice in the island. Hollow-shaft motors for deep-well pumping are also being supplied to Israel and Thailand.

Although Brook Motors, Ltd., exported a large part of their output during the year, they do not, in common with many manufacturers of smaller items of equipment, always know the ultimate destination of their products, since these are usually shipped through agents and sold to contractors. Nevertheless, the company report that they did over a million dollars' worth of business in the United States last year and that there is a good chance that this figure will be increased in 1958. An intensive sales drive is also planned for Canada. An increased number of small motors were supplied to New Zealand for agricultural work and orders were received from Australia for larger frame motors for widely varying projects from atomic plants to irrigation. Seven 150 h.p. low-speed motors were also supplied to Australia for special duties. Increasing competition from Germany was encountered during the year, but the company feel that the new trends in motor design to British Standards will help to counteract this.

The first batch of vertical hollow-shaft pump motors for Formosa (Newman Industries)

For the Ulan power station, New South Wales, W. H. Allen, Sons & Co., Ltd., supplied two 3,125 kW turbo-alternators and their associated plant. The turbines, which run at 5,000 r.p.m. and operate on steam at 400 lb/sq in and 700 deg F, have two bled steam points. The totally enclosed, water-cooled alternators are driven through speed reduction gears, and operate at 0·8 power factor, 11 kV, three-phase, 50 c/s and 1,500 r.p.m.

Other generating plant supplied to Australia included a three-cylinder, two-stroke diesel engine directly coupled to a 274 kW alternator for Bordertown, South Australia; and three six-cylinder and one eight-cylinder two-stroke diesel engine driven generator sets which provide a continuous output of 2,130 kW for the Rum Jungle uranium mine and its associated township in the Northern Territory. Four 300 kW turbo-alternators were supplied to Canada for installation in two cargo vessels being built by Collingwood Shipyards, Ltd.

Also sent to Canada were two vertical main circulating water pumps for the Wabamum power station of Calgary Power, Ltd. These pumps, which are of the mixed-flow suspended type with 33in discharge branches, are designed for a capacity of 23,500 imperial gallons of fresh water a minute against a head of 25ft. They run at 370 r.p.m. and are driven by 285 h.p. vertical-spindle splash-proof induction motors. A further two units are on order for installation in the same station. Circulating water pumps have also been supplied for the Salisbury power station, Southern Rhodesia, and the Pretoria and Taaibos power stations in South Africa. The two double-suction, two-stage pumping sets in the last station, which is the largest power station in the Union, have a total capacity of 800,000 gallons per hour against a head of 475ft. The pumps are driven at 1,485 r.p.m. by 1,245 h.p. motors and deliver water to the power station from the Vaal River.

During the year hydro-electric and steam turbine generating sets manufactured by the English Electric Co., Ltd., were commissioned in many countries. They included the first 37,500 kW turbine and alternator at the Hirakud hydro-electric station in India; a 25 MW set at Hume, Australia; a 18 MW set at Tully Falls, Tasmania; and three 12,750 kW sets at Wayatinah "B," Rhodesia. The second 84,736 kVA water-wheel alternator was put into service at McNary Dam, United States, as was the first of the three pump turbines at Niagara. The 45 MW, 3,600 r.p.m., turbo-alternator at Water Street power station of the Nova Scotia Light & Power Co., Ltd., operates at 900 lb/sq in and 900 deg F. Other steam sets commissioned were one of 30 MW at Umgeni power station and another of the same capacity at Pretoria "B"; a 14,250 kW "topping" set at St. George's Bay power station, Athens; and two further 10 MW sets at Penang. The first of two 200 MVA, 165 kV, three-phase transformers was shipped to the Tennessee Valley Authority. A twin motor 4,040 h.p. geared a.c. mine winder was commissioned in South Africa and a 1,425 h.p. geared a.c. winder in Southern Rhodesia.

Domestic Appliances

Hard selling was the keynote of the export activities of the General Electric Co., Ltd., in the domestic field, and teams of expert house-

craft demonstrators visited East Africa and the Caribbean area. The 1957 Caribbean tour followed a policy started some six years ago when it was decided that unless positive action was taken, trade within the area was likely to suffer due to the proximity of the United States and the dependence of the area on tourist trade. To serve Trinidad and Tobago a new company was formed. A special drive was also made in Malta following the conversion of that island's electricity supply to 50 c/s.

In addition to the normal British wares specially developed *kwali* hotplates have been sold both as individual units with a three-heat switch control and fitted to conventional cookers. These hotplates are designed to take the convex-bottomed vessels in which rice and other staple foods are cooked in Afro-Asian countries and communities.

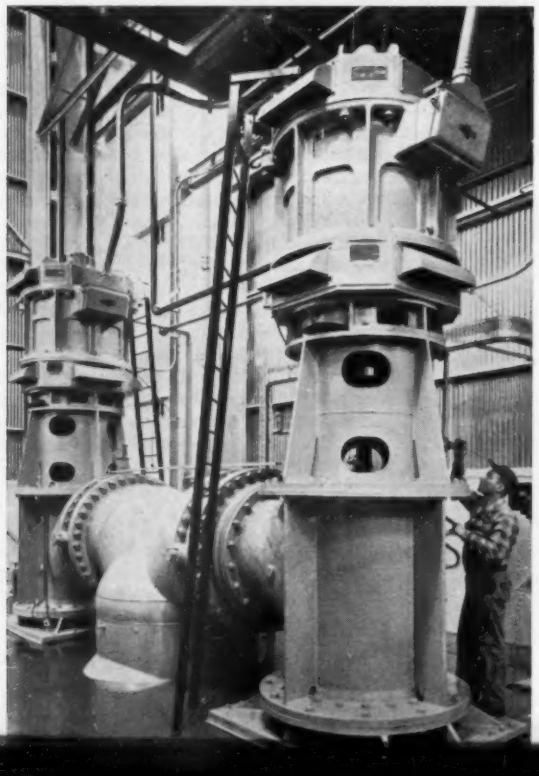
Last year Best Products, Ltd., exported 60 per cent more of their appliances than in 1956. In addition to increased quantities going to New Zealand, Central and South Africa, new markets were opened up in Denmark, Belgium and the Philippines. Local production of kettle elements was started in South Africa, and a larger number of thermo-couples was supplied to the United States.

The success in this country of the " Debonair " spin dryer made by the Simplex Electric Co., Ltd., was reflected in many overseas territories. It is said to be particularly acceptable in those countries which, though hot, have a high humidity. Creda " Star " and " Stargazer " cookers are being manufactured under licence in Australia.

Chilton Electric Products, Ltd., supplied their shaver sockets to hotels in Lisbon, Madeira, Baghdad, Gibraltar and Brussels. In addition to Commonwealth countries, Dimplex oil-filled radiators were exported to Western Europe, the United States, Uruguay, the Middle East and Japan, and skirting board convector heaters were introduced into the United States and Canada.

About half the total production of the Hoover factories in this country is exported and manufacture is also carried out by subsidiary companies in France, Finland and Australia. Hoover market overseas seven different types of vacuum cleaner, four models of washing machine, a polisher-scrubber and a steam-or-dry iron. Their overseas organisation consists of 13 subsidiary companies, resident managers in various territories, distributors in well over 100 countries and representatives in every country this side of the Iron Curtain. It is expected that the success in 1956 in the United States and Canada, when goods valued at over $3 million were sold, was repeated.

Two Allen main circulating-water pumps in Wabamum power station, Canada



This Singapore housewife is using one of the G.E.C. kwali hotplates

The English Electric Co., Ltd., attribute a good deal of the success achieved last year in over 100 countries to personal visits of members of the domestic appliance export sales office. Representatives are chosen because of their ability to speak the language of the country visited, and in the early part of the year one of the company's senior home economists worked with the French agents at the *Arts Ménager* exhibition in Paris. To keep agents and dealers up to date in the servicing of the company's appliances, members of the export division service department, with a completely equipped van, covered many thousands of miles in the remoter parts of Europe and Scandinavia. Both sales and technical representatives keep in touch with trends in Continental and American designs and styling by frequent visits to overseas trade fairs and to agents' territories. From this close liaison it has been possible to develop and modify appliances to suit local conditions.

The highlight of the year for Berry's Electric, Ltd., was the increase of 300 per cent in the exports of " Magicoal " and " Berrylog " fires to the United States. In 1957 Berry's Electric exported to 93 countries, and the Middle East, which took 20 per cent of the total, remained one of their most important markets. In view of the recent import licensing arrangements, particular interest attaches to the agreement, reached after two years' negotiations, whereby the company's electric fires are exported to New Zealand in a state of sub-assembly, to be finished by local labour and marketed as home-produced products.

WORLD ELECTRICAL IMPORTS

DATA SPECIALLY PREPARED BY THE *ELECTRICAL REVIEW* SHOWING THE PRINCIPAL MARKETS AND THE QUANTITIES AND DISTRIBUTION OF BRITISH ELECTRICAL EQUIPMENT

THE accompanying table gives the individual electrical imports of the world's principal markets, valued in £ million. The statistics show the proportion of the trade taken by the four principal supplying countries in 1955 and 1956. This division is based upon trade figures published by international organisations and the individual countries and does not necessarily tally exactly with trade statistics of individual market surveys published previously in the *Electrical Review*.

The world map indicates the countries to which British electrical goods are exported, the value of these exports being shown in each case.

An analysis of the main markets shows that in general the position of the first two principal suppliers has remained unchanged since 1955 (*Electrical Review*, 3rd May, 1957). Canada, as previously, ranks first with imports valued at £106 million, followed by the Netherlands with £6 The bulk of Canada's imports was supplied by th States (86 per cent), the United Kingdom's share per cent.

Within Europe, the six "Messina" countries un are not only the most active competitors, but also markets. In view of the prospect of a European F Area it may be helpful to survey briefly the market p in these countries. With the progressing standard and further industrialisation, the Messina countries of their large local industries, will need nuclea (experimental and power), isotopes, nuclear instru and nucleonic equipment, electronic components a domestic appliances. The last include vacuum clea polishers, washing machines and dry shavers.

Abbreviations used in tables below: Au.=Austria. Be.=Belgium. Ca.=Canada. Chi.=China. De.=Denmark. E.G.=East Fra.=France. It.=Italy. Ja.=Japan. Ne.=Netherlands. Swe.=Sweden. Swi.=Switzerland. U.K.=United Kingdom. U.S.=Uni W.G.=West Germany

	TOTAL IMPORTS		IMPORTING COUNTRIES AND THEIR SUPPLIERS (values in £ million												
Country	1956	1955		1956		1955		1956		1955		1956		1955	
ARGENTINA...	12·6	12·2	W.G.	6·1	W.G.	4·0	U.S.	3·0	Ne.	2·8	It.	1·8	U.S.	1·9	U.K.
AUSTRALIA ...	32·5	28·8	U.K.	21·2	U.K.	21·0	U.S.	3·6	U.S.	1·8	W.G.	1·6	W.G.	1·7	Ne.
AUSTRIA ...	12·9	10·5	W.G.	8·3	W.G.	6·5	Swi.	1·4	Swi.	1·1	Ne.	1·1	Ne.	1·0	U.S.
BELGIUM ...	36·6	31·2	W.G.	13·0	W.G.	9·8	Ne.	8·6	Ne.	7·4	U.S.	4·8	U.S.	4·5	U.K.
BOLIVIA ...	1·9	1·6	U.S.	0·5	U.S.	0·5	Ne.	0·5	Swe.	0·3	W.G.	0·4	W.G.	0·3	Swe.
BRAZIL ...	16·4	16·3	U.S.	6·5	U.S.	6·0	Be.	2·1	W.G.	3·4	U.K.	1·8	Be.	1·9	W.G
BURMA ...	2·5	2·5	U.K.	1·3	U.K.	1·8	W.G.	0·4	W.G.	0·4	Swe.	0·2	U.S.	0·1	Chi.
CANADA ...	106·2	90·8	U.S.	90·0	U.S.	79·0	U.K.	12·7	U.K.	8·3	Swi.	1·3	Swi.	0·8	Ne.
CEYLON ...	3·3	2·5	U.K.	2·3	U.K.	1·5	W.G.	0·5	Ne.	0·3	Ne.	0·3	W.G.	0·3	U.S.
CHILE	4·9	3·2	U.S.	2·4	U.S.	1·1	W.G.	1·7	W.G.	1·1	U.K.	0·4	U.K.	0·3	Ne.
COLOMBIA ...	17·3	16·9	U.S.	10·4	U.S.	9·4	W.G.	3·2	W.G.	2·5	Swe.	1·5	Au.	1·4	Ne.
CUBA	14·6	12·9	U.S.	12·6	U.S.	10·1	W.G.	0·7	W.G.	0·4	U.K.	0·4	Ne.	0·3	Ne.
DENMARK ...	10·2	8·4	W.G.	3·1	W.G.	2·3	U.K.	2·3	U.K.	1·8	Ne.	1·8	Swe.	1·7	Swe.
EAST AFRICA	5·7	5·7	U.K.	4·6	U.K.	4·2	W.G.	0·4	W.G.	0·4	Ne.	0·3	Ne.	0·3	U.S.
ECUADOR ...	2·3	2·5	U.S.	1·0	U.S.	0·9	W.G.	0·6	W.G.	0·7	Swe.	0·2	Swe.	0·2	Ne.
EGYPT	13·4	13·2	W.G.	2·5	W.G.	2·8	Fra.	2·0	Fra.	2·0	U.K.	1·7	U.K.	1·7	Swi.
EIRE	5·9	6·9	U.K.	3·4	U.K.	4·1	W.G.	1·1	W.G.	1·0	Swi.	0·3	Swi.	0·5	Swe.
FINLAND ...	13·0	10·4	W.G.	4·1	W.G.	3·6	Swe.	2·3	U.K.	1·7	U.K.	1·9	Swe.	1·3	Den.
FRANCE ...	28·7	21·8	W.G.	9·0	W.G.	6·4	U.S.	8·2	U.S.	5·9	Ne.	4·3	U.K.	3·1	U.K.
GHANA ...	2·4	2·3	U.K.	1·7	U.K.	1·8	W.G.	0·3	W.G.	0·2	U.S.	0·2	U.S.	0·1	Ne.
GREECE ...	6·5	5·5	W.G.	2·4	W.G.	2·5	U.K.	2·4	U.K.	1·3	Ne.	0·5	U.S.	1·0	It.
HONG KONG	4·1	3·9	U.K.	2·7	U.K.	2·7	W.G.	0·6	W.G.	0·5	U.S.	0·5	U.S.	0·4	Ne.
INDIA	33·2	25·3	U.K.	21·2	U.K.	16·2	U.K.	5·4	W.G.	4·3	W.G.	2·3	U.S.	2·2	Ne.
INDONESIA ...	8·4	6·4	Ne.	2·6	Ne.	2·3	W.G.	2·5	W.G.	1·8	U.S.	2·4	U.S.	1·2	U.K.
IRAN	7·8	6·7	W.G.	3·1	W.G.	2·1	U.K.	2·2	U.S.	1·5	U.S.	1·9	U.K.	0·8	Ne.
IRAQ	8·5	5·5	U.K.	3·2	U.K.	2·3	W.G.	1·0	W.G.	1·1	U.S.	0·8	U.S.	0·8	Ne.
ITALY	26·1	21·2	W.G.	10·5	W.G.	7·4	Au.	7·2	Au.	7·0	U.S.	5·3	U.S.	5·0	U.K.

RTS

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dom's share being 12

countries undoubtedly
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European Free Trade
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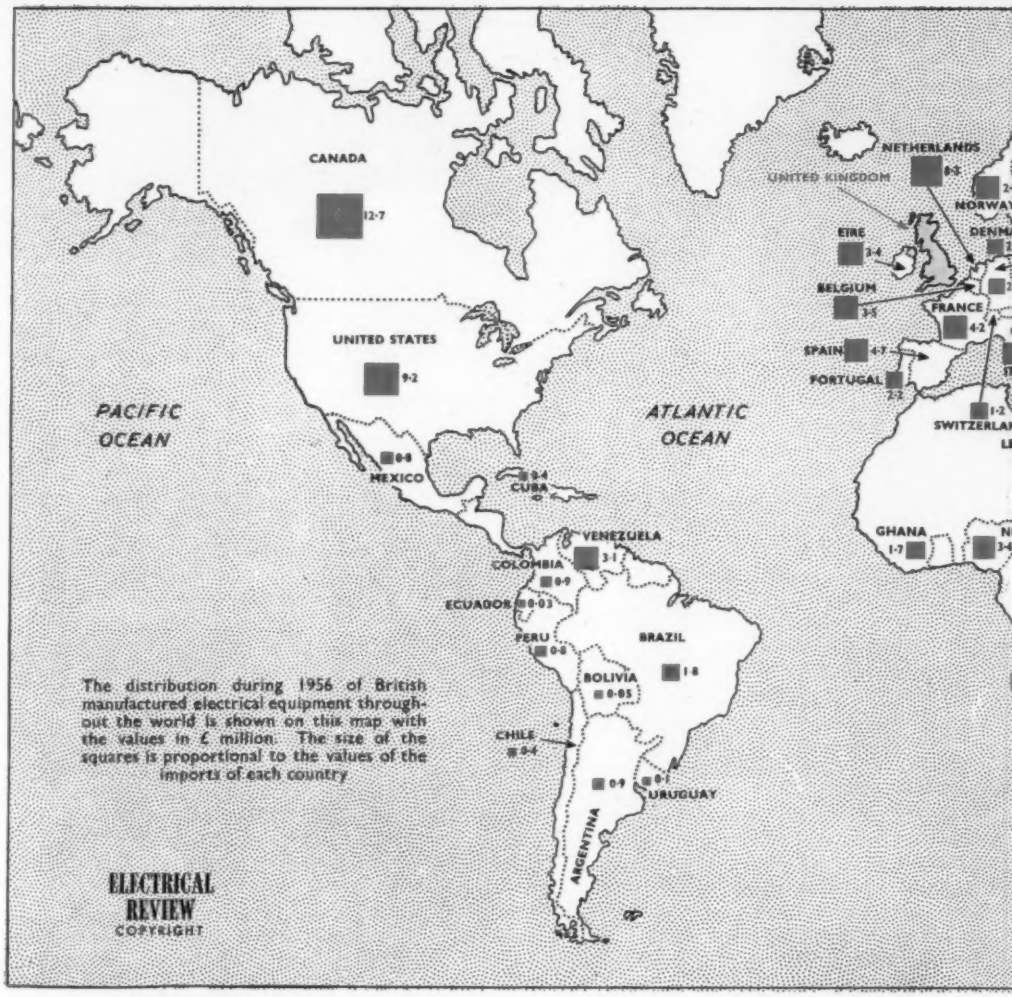
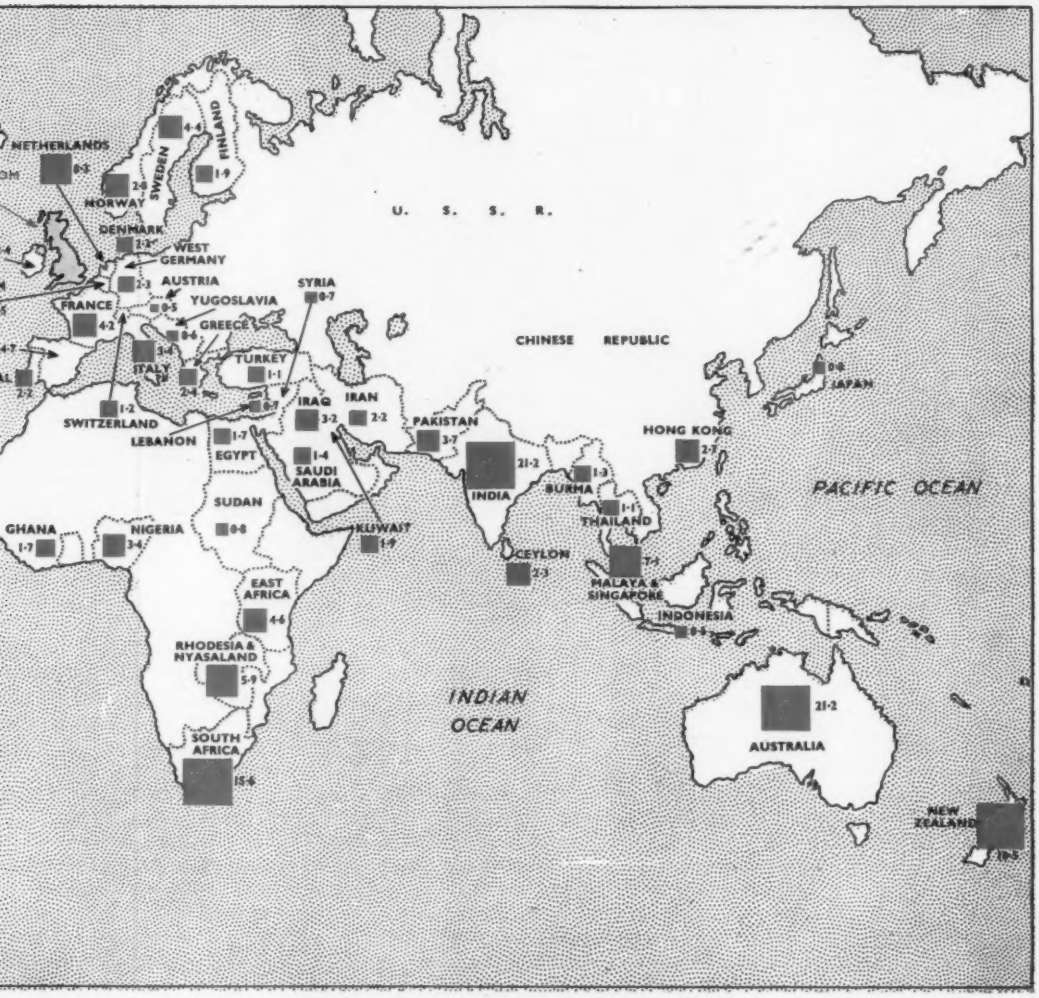
. E.G. = East Germany.
n. U.S. = United States.



es in £ million)						TOTAL IMPORTS			IMPORTING			
1955	1956		1955	1956	1955	Country	1956	1955	1956		1955	
1·9	U.K.	0·9	U.K.	1·7	U.K. value only	JAPAN	8·1	6·3	U.S.	5·7	U.S.	4·7	U.K.
1·7	Ne.	0·6	Ne.	0·9		KUWAIT	3·4	3·0	U.K.	1·9	U.K.	1·4	U.S.
1·0	U.S.	0·6	U.K.	0·5	0·5	LEBANON	3·3	2·8	U.S.	1·1	U.S.	1·0	W.G
4·5	U.K.	3·5	U.K.	3·2		MALAYA & SINGAPORE	10·9	10·4	U.K.	7·1	U.K.	6·6	Swe.
0·3	Swe.	0·3	Fra.	0·1	0·05	0·02	MEXICO	22·3	16·9	U.S.	17·1	U.S.	12·8	W.G
1·9	W.G.	1·8	Fra.	1·4		0·8	NETHERLANDS	62·4	49·1	W.G.	24·2	W.G.	19·0	Be.
0·1	Chi.	0·2	Ne.	0·1			NEW ZEALAND	14·5	15·0	U.K.	10·5	U.K.	12·3	Be.
0·8	Ne.	0·9	Swe.	0·5			NIGERIA	5·0	4·6	U.K.	3·4	U.K.	3·1	W.G
0·3	U.S.	0·1	U.S.	0·1			NORWAY	14·2	14·4	W.G.	5·1	W.G.	5·0	U.K.
0·3	Ne.	0·2	Fra.	0·1			PAKISTAN	8·9	8·4	U.K.	3·7	U.K.	3·8	W.G
1·4	Ne.	1·1	Swe.	1·3	0·9	0·9	PERU	7·8	6·5	U.S.	4·5	U.S.	3·0	W.G
0·3	Ne.	0·3	U.K.	0·3			PORTUGAL	6·6	5·8	W.G.	2·3	U.K.	2·2	U.K.
1·7	Swe.	1·7	Ne.	1·5			RHODESIA & NYASALAND	11·2	9·7	U.K.	5·9	U.K.	5·8	Ne.
0·3	U.S.	0·2	U.S.	0·1			SAUDI ARABIA	5·5	5·3	U.S.	2·2	U.S.	2·0	U.K.
0·2	Ne.	0·1	Ne.	0·2	0·03	0·04	SOUTH AFRICA	25·7	24·8	U.K.	15·6	U.K.	18·0	U.S.
1·7	Swi.	1·6	Swi.	1·4			SPAIN	12·5	11·2	U.K.	4·7	Fra.	3·7	Fra.
0·5	Swe.	0·3	U.S.	0·3			SUDAN	1·9	1·4	U.K.	0·8	U.K.	0·9	Ne.
1·3	Den.	0·9	Ne.	0·9			SWEDEN	32·9	27·4	W.G.	14·8	W.G.	12·8	U.K.
3·1	U.K.	4·2	Ne.	2·2			SWITZERLAND	17·8	15·5	W.G.	11·8	W.G.	9·1	U.S.
0·1	Ne.	0·1	Ne.	0·1			SYRIA	2·6	2·4	W.G.	0·8	W.G.	0·6	U.K.
1·0	It.	0·3	Ne.	0·6			THAILAND	5·1	4·6	U.S.	1·7	U.K.	1·7	U.K.
0·4	Ne.	0·3	Ne.	0·2			TURKEY	9·3	10·9	W.G.	2·3	W.G.	4·1	U.K.
2·2	Ne.	1·1	Ne.	1·1			UNITED KINGDOM	23·7	23·5	U.S.	7·1	Ne.	6·0	W.G.
1·2	U.K.	0·6	U.K.	0·4			UNITED STATES	44·1	24·2	U.K.	9·2	U.K.	5·2	W.G.
0·8	Ne.	0·3	Fra.	0·5			URUGUAY	3·1	2·9	U.S.	0·6	U.S.	1·1	W.G.
0·8	Ne.	0·5	Ne.	0·5			VENEZUELA	27·6	25·3	U.S.	18·1	U.S.	13·7	W.G.
5·0	U.K.	3·4	U.K.	2·9			WEST GERMANY	17·6	15·3	Ne.	4·8	Ne.	4·1	Swi.
							YUGOSLAVIA	6·3	7·9	W.G.	2·9	W.G.	2·8	It.



IMPORTING COUNTRIES AND THEIR SUPPLIERS (values in £ million)

	1955		1956		1955		1956		1955		1956		1955	1956	1955
	4·7	U.K.	0·8	U.K.	1·1	W.G.	0·5	W.G.	0·2	Swi.	0·3	Swi.	0·2	U.K. value only	
	1·4	U.S.	0·4	U.S.	0·3	W.G.	0·4	W.G.	0·3	Ne.	0·2	Ne.	0·1		
	1·0	W.G.	1·0	W.G.	0·8	U.K.	0·7	U.K.	0·4	Ne.	0·2	Ne.	0·1		
	6·6	Swe.	1·5	Ne.	1·1	W.G.	1·4	W.G.	0·7	U.S.	0·3	U.S.	0·4		
	12·8	W.G.	1·1	W.G.	1·0	It.	0·9	Swe.	0·9	U.K.	0·8	It.	0·9		0·5
G.	19·0	Be.	17·0	Be.	13·8	U.K.	8·3	U.K.	6·8	Swi.	3·6	Swi.	2·5		
	12·3	Be.	1·1	Be.	0·9	It.	0·7	It.	0·6	Ne.	0·6	Ne.	0·5		
	3·1	W.G.	0·4	W.G.	0·4	U.S.	0·1	U.S.	0·1	Ne.	0·1	Ne.	0·1		
G.	5·0	U.K.	2·8	Swe.	4·5	Swe.	2·3	U.K.	3·4	Den.	1·1	Ne.	1·2		
	3·8	W.G.	2·5	W.G.	2·9	U.S.	1·8	U.S.	0·6	Ne.	0·5	Ne.	0·3		
	3·0	W.G.	1·6	W.G.	1·1	U.K.	0·8	U.K.	0·6	Ne.	0·5	Ne.	0·5		
	2·2	U.K.	2·2	W.G.	1·9	Fra.	0·6	U.S.	0·9	Ne.	0·5	Ne.	0·5		
	5·8	Ne.	0·3	Ne.	0·2	W.G.	0·3	U.S.	0·1	U.S.	0·2	W.G.	0·4		
	2·0	U.K.	1·4	U.K.	1·0	W.G.	1·0	Ne.	0·7	Ne.	0·6	W.G.	0·7		
	18·0	U.S.	3·5	U.S.	3·8	W.G.	2·2	W.G.	1·6	Ne.	1·0	Ne.	1·3		
	3·7	Fra.	3·2	W.G.	2·0	W.G.	2·4	U.K.	1·7	Be.	1·3	U.S.	1·1		
	0·9	Ne.	0·5	U.S.	0·2	W.G.	0·3	W.G.	0·1	U.S.	0·2	Ne.	0·1		
G.	12·8	U.K.	4·4	U.K.	4·2	Ne.	4·3	Ne.	3·8	U.S.	2·1	U.S.	2·3		
G.	9·1	U.S.	2·2	U.S.	1·7	Ne.	1·6	Ne.	1·5	U.K.	1·2	U.K.	1·0		
G.	0·6	U.K.	0·7	U.S.	0·6	U.S.	0·4	U.K.	0·4	Fra.	0·4	Fra.	0·3		
	1·7	U.K.	1·1	U.S.	1·1	W.G.	1·1	Ne.	0·9	Ne.	0·8	W.G.	0·8		
G.	4·1	U.K.	1·1	U.K.	1·2	Fra.	0·8	U.S.	0·8	E.G.	0·6	Fra.	0·7		
	6·0	W.G.	3·9	U.S.	5·0	Ne.	3·7	W.G.	4·5	Ca.	1·3	Swi.	1·0		
	5·2	W.G.	8·5	W.G.	4·7	Ca.	5·5	Ca.	3·4	Ja.	4·3	Ne.	1·8		
	1·1	W.G.	0·4	W.G.	0·9	Fra.	0·5	Fra.	0·4	Ne.	0·2	U.K.	0·4	0·1	
	13·7	W.G.	4·3	W.G.	4·9	U.K.	3·1	U.K.	2·4	Ne.	1·4	Ne.	1·0		
	4·1	Swi.	3·4	Swi.	2·9	U.S.	2·8	U.S.	2·4	U.K.	2·3	U.K.	2·1		
G.	2·8	It.	0·9	It.	1·4	Au.	0·8	Au.	0·8	Swi.	0·7	U.K.	0·7	0·6	

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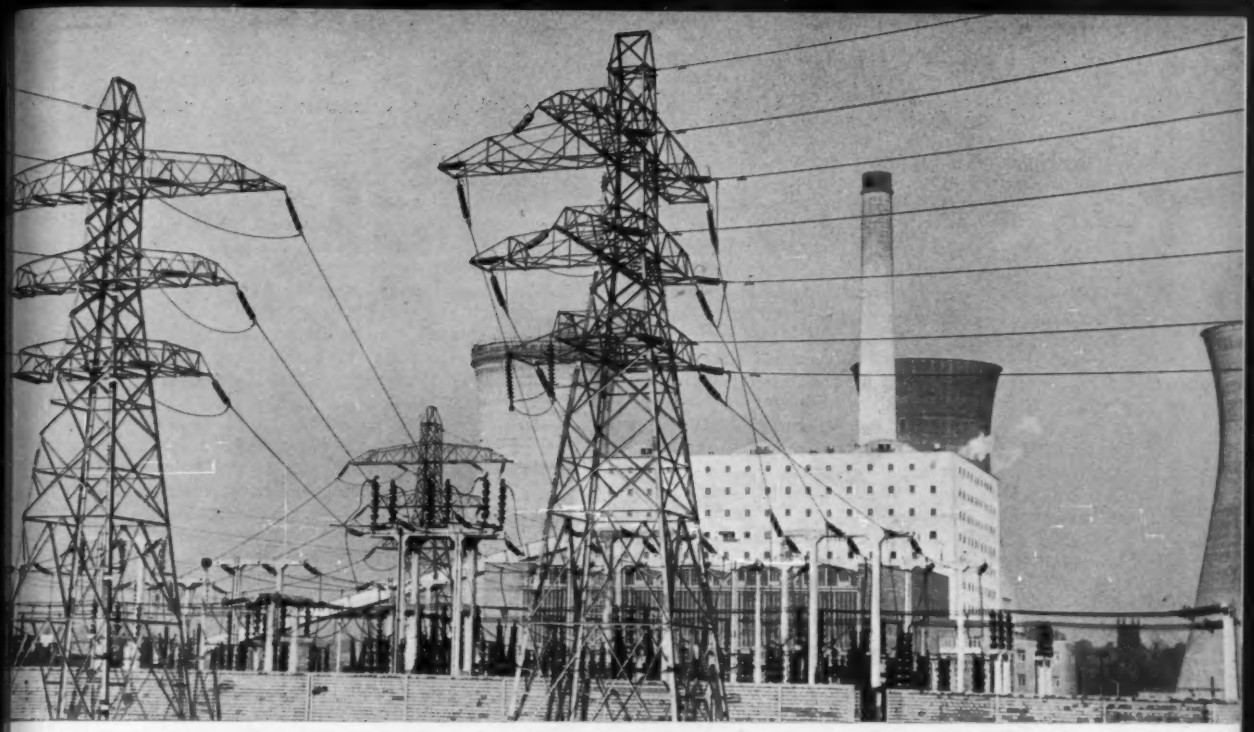


Electrical Review 31 *January* 1958

Ten Years' Generation Progress

BRITISH "SHOWROOM" FOR EXPORT TRADE

IN the early days of nationalisation of the electricity supply industry many important people pointed out how well the power stations, which were provided for in the new Authority's programme, would serve as a "showroom" for the benefit of overseas visitors. We believe that that forecast has worked out very well. Great advances have been made and we consider that the annual export number of the *Electrical Review* provides a good opportunity to recount what has been done.

In undertaking our preparatory survey we sought the aid of the supply authorities, various papers published by the Institutions, and, particularly, the manufacturers.

In their contribution to this survey Babcock & Wilcox, Ltd., say that few realise the tremendous advance that has taken place in boiler design since the war; for example, the first report of the British Electricity Authority showed that in 1949 over 65 per cent of its generating capacity operated at, or below, 450 p.s.i., and some 33 per cent between 450 and 650 p.s.i. To-day, pressures of 1,600 p.s.i. are common, while a number of units are being built to operate at 2,450 p.s.i. In outputs the increase is even more striking. In 1948-49, the largest boiler commissioned was for 365 klb/hr, while the average of the 33 boilers put into operation for the B.E.A. was only just over 200 klb/hr. To-day, boilers for 1½ and 2 thousand klb/hr are under construction.

To see the progress of generation in the past ten years in its true perspective, however, we feel it is necessary to go back to at least a little before the commencement of the last war. As the British Thomson-Houston Co. put it, immediately before the war turbo-alternators rated at 30 MW, 3,000 r.p.m., could be regarded as the largest standard machines. Sets of larger ratings, indeed up to 100 MW, had been constructed, but these ran at 1,500 r.p.m., and while they had a very satisfactory record of reliability they were proved to be uneconomic in consequence of the large amount of materials incorporated, the large space required for their accommodation, and their lower efficiency. They were also operationally less flexible than the later 3,000 r.p.m. units. C. A. Parsons & Co., Ltd., take us back much earlier, saying that at the beginning of the present century the largest turbo-alternator built was for an output of 350 kW.

The combination of high speed and large output introduces constructional problems which become more serious as the output is increased. The first orders were for machines of 60 MW with steam conditions of 1,500 p.s.i. and 1,050 deg F. Next came orders for machines of 100 MW output to operate with steam conditions of 1,500 p.s.i. and 1,050 deg F, and others of the same rating but with initial steam conditions of 1,500 p.s.i. and 975 deg F, with reheat to 950 deg F. Sets ordered for Canada will be of the cross-compound design consisting of a high-pressure line driving a 100 MW alternator at 3,600 r.p.m. and a low-pressure line driving a second 100 MW machine at 1,800 r.p.m. The steam conditions are 1,800 p.s.i. and 1,000 deg F, with reheat to 1,000 deg F.

Lord Citrine summed up the position very well when he presented the 1956-57 C.E.A. Annual Report last September. He said that since 1948 the electricity supply

Title picture: Ferrybridge "B" generating station, near Pontefract, will ultimately have three 100 MW turbo-alternators operating on the re-heat cycle. It was designed within the period under review and was commissioned last year

industry had doubled in size and provision had been made to meet the anticipated doubling of demand again in the next eight to ten years. The generating capacity in 1948 was 10,360 MW; in 1957 it was 20,640 MW; and by 1965 it will be of the order of 36,000 MW. Technological and other advances that have resulted from the large-scale operations made possible by the national co-ordination of the supply industry have been outstanding. Whereas in 1947-48 the majority of generating sets on order were of 30 and 60 MW sizes, units of 100 and 120 MW were now coming into operation. The highest thermal efficiencies at which the best modern stations were operated were 30 to 31·5 per cent, and the overall average efficiency of generation for all the Authority's stations last year was 24·93 per cent. A broader picture of generation statistics, in the *Electrical Review* article "Generation in Great Britain," was published on 14th June, 1957, at the time of the British Electrical Power Convention at Eastbourne. We showed then, *inter alia*, that the ten individual C.E.A. stations with the highest thermal efficiencies were led by Littlebrook "B" (30·6 per cent), and that stations with the highest outputs included Skelton Grange "A" (2,385 million kWh).

Before vesting day, stations with thermal efficiencies of about 25 per cent cost £50/kW. Since that time costs have risen by 75 per cent, but newer stations are costing about £45/kW and have thermal efficiencies of 33·5 per cent. The British grid gives scope for the installation of very large generating sets; American utilities are prepared to install units having outputs up to a maximum of 10 per cent of the system capacity, and, on the same basis, theoretically we could install 2,000 MW units.

Influence of the Grid

On the question of the influence of the grid, Messrs. F. H. S. Brown and E. S. Booth, at the B.E.P.C. last year, said that in a fully interconnected system like that of the C.E.A. no single power station functioned in isolation and consequently was neither designed, nor operated, as an isolated entity. Thermal efficiency was, of course, important in these days of shortage of primary fuels, but nevertheless fuel was only one component of the total cost of generation of electricity and thermal efficiency was not the sole criterion in the design of a power station. It was no longer necessary to take every possible precaution against trouble, and straight engineering problems could be considered on their merits without restrictions at every conceivable point.

Pattern of Development

In a paper presented last year at the 19th annual meeting of the American Power Conference, Mr. J. W. H. Dore, plant design engineer, C.E.A., said that the pattern of plant development in Great Britain had been strongly influenced by the requirement of two-shift operation, that is of shutting down at night and running up again in the morning. With comprehensive interconnection of stations, an average load factor only of the order of 40 per cent, and the cost of fuel delivered to major stations varying over a range of 1·6 to 1, the lowest cost of generation was obtained by installing the most efficient plant on sites where the fuel costs were lowest and meeting the major load variations by shutting down and starting up individual sets rather than operating all at varying loads.

Economy is now the keynote of design and all British manufacturers have made great efforts to produce generators of large output with minimum size and weight. Any possible reduction in size for a specified rating results in a substantial saving in civil engineering costs and limitations of size and weight are also imposed by transport considerations.

Metallurgical considerations have a considerable bearing on advance and this is stressed by Aiton & Co. who say that in the past ten years the C.E.A. commissioned or placed orders for boilers and turbines which may be identified with the following ranges of operating pressure and temperature: 900 p.s.i., 900 deg F; 1,500 p.s.i., 1,000 deg F, with reheat to 1,000 deg F; 1,500 p.s.i., 1,050 deg F; 2,350 p.s.i., 1,050 deg F, with reheat to 1,000 deg F. The company has designed, manufactured and put into service austenitic stainless steel pipework operating at 1,500 p.s.i. at Stourport "B" and Drakelow power stations and chrome-molybdenum-vanadium pipework operating under similar conditions at Castle Donington.

One of the most important duties associated with heavy castings operating under high duty is to ensure that the castings are sound, and free from cracks or other defects which might result in trouble while the turbines are running. The David Brown Foundries Co., with considerable support from the C.E.A., developed a method of avoiding such defects.

While, say Babcock & Wilcox, for metallurgical reasons, the temperature curve during the last ten years has risen only slightly and appears to have flattened out at around 1,100 deg F, pressures have risen sharply from about 600 p.s.i. to a figure approaching the critical pressure of 3,200 p.s.i.

Advanced Steam Conditions

Clarke, Chapman & Co., Ltd., say that the main contributory factors to the gradually increasing size of boiler-turbo-alternator units has been the great increase in the annual rate of power consumption; economy of the large generating units compared with the smaller sizes; the thermo-dynamic gains obtained from the adoption of advanced steam cycles; lower capital costs of power units and housing resulting from reduction in building volume and floor space per kW installed. The increase in size of power station units during the past ten years is shown in Table 1.

Table 1.—Increase in Size of Power Station Units in the Last Ten Years

Years	Unit Size	Steam Conditions at Turbine Stop Valve		Boiler Evaporation klb/hr	Remarks
	Output from Alternator MW	Pressure p.s.i.	Temperature deg F		
pre 1948	30	600	850	300	—
1948	60	950	925	550	—
1954	120	1,600	1,060	860	Reheat
1955	200	2,450	1,055	1,350	,,
1958	275	2,400	1,055	1,950	,,
1958	*550	2,400	1,055	3,800	,,

* Proposed design.

Table 2, from the B.E.P.C. paper by W. F. Simonson, gives the steam conditions and capital cost position at a glance.

Table 2.—Effect on Costs of Advancing Steam Conditions

Unit Size MW	Steam Conditions at Turbine Stop Valve		Cost of Boiler Plant per kW £
	p.s.i.	deg F	
30 Range boilers ...	600	850	28·6
30 Unit ,, ...	600	850	23·6
60 ,, ,, ...	900	900	18·7
100 ,, ,, ...	1,500	1,050	17·5
100 Reheat, Unit boilers	1,500	975/950	17·5
120 ,, ,, ,,	1,500	1,000/1,000	14·0
200 ,, ,, ,,	2,350	1,050/1,000	12·4

After this review of advanced steam conditions the following comment by the South of Scotland Electricity Board is interesting. The primary development which

has taken place in the South of Scotland is the installation of three 60 MW cross-compound sets at Portobello which has been the most efficient Scottish station for several years. Higher temperatures and pressures demand greater purity of boiler feed water and a reduction, as far as possible, of impurities carried over into the turbine. In this respect they suggest a study of the use now being made of hydrazine for boiler feed and condenser conditioning. Experience with this treatment is being obtained at the Stella power station.

In Table 3 we give a list of turbo-alternators made by one manufacturer which is fairly representative of the development as a whole throughout the country in the past decade or so.

All this seems to be brought into a reasonable perspective by the following passage in Mr. Dore's American Power Conference paper. He says that the national situation required immediate plans to be based on obtaining the greatest rate of installation of new capacity from available sources and the result was that the new plant programmed for commissioning in the years up to 1954 was almost exclusively of standard types with stop-valve conditions of 600 p.s.i. at 850 deg F and 900 p.s.i. at 900 deg F. The exceptions were some 60 MW sets with steam at 1,250 to 1,350 p.s.i. and 950 deg F and 1,235 p.s.i. and 825 deg F, with reheat to 825 deg F, which represented a revival of pre-war plans.

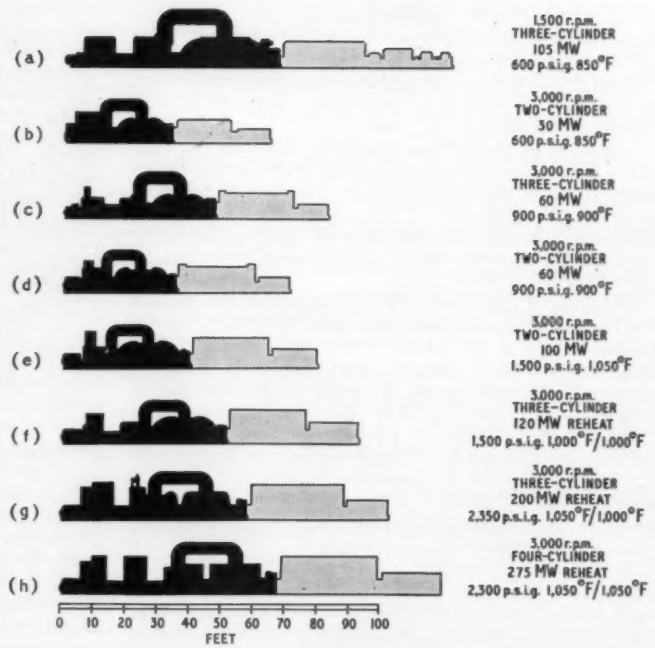


Fig. 1.—Indication of the advance in generation: **(a)** *Battersea "A" station, 105 MW at 1,500 r.p.m., 1935;* **(b** *and* **c)** *30 MW and 60 MW units of the immediate post-war period;* **(d** *to* **g)** *current standard units;* **(h)** *275 MW project*

The current stage of development then can be taken to have begun in 1954 when final decisions had to be made about new installations to be commissioned in 1959. Study of the factors affecting rating established that for a unit incorporating a tandem compound turbine the generator imposed the limit, but that the progress made in generator design, with internal cooling of the conductors extended to the stator as well as to the rotor, had made it practicable to design for a rating of 200 MW whilst still keeping the transport weight within permissible limits.

Here we can quote the following general conclusions taken from an economic study presented by Mr. L. S. Robson (Metropolitan-Vickers) in a B.E.P.C. paper:—

1. Thermal efficiency and fuel consumption are improved as initial pressures and, in particular, initial temperatures are raised.

2. Reheating offers an additional thermal gain of the order of 5 per cent as compared with non-reheating plant.

3. Reheat stations need be no more expensive than non-reheat stations of the same capacity.

4. With economic pressures and temperatures the capital cost of stations per MW installed falls steadily as unit ratings are increased; for 200 MW units the capital cost is about two-thirds of that for 30 MW units.

5. Economic pressures and temperatures increase with unit ratings and for reheat plant are slightly lower than non-reheat.

6. Slight departures from the most economic conditions produce only slight increases in the cost of generation.

A visual appreciation of what has been achieved by technological progress may be gained from Fig. 1 which shows a range of 3,000 r.p.m. standard turbine generating units with which Mr. Robson has been associated. For comparison the silhouettes are headed by the 105 MW machine installed at Battersea in 1935, a milestone in tandem-turbine design at the pre-war standard for large units running at 1,500 r.p.m.

Following this it is appropriate to refer to the larger boilers which such modern steam conditions demand. There is the Loeffler boiler, for instance, with pressures up to, say, 2,000 p.s.i. One installation of boilers of this type has been operating for nearly twenty years at an m.c.r. of some 250 klb/hr at 2,000 p.s.i. and 940 deg F. In this system, which has been pioneered by Mitchell Engineering, Ltd., the evaporating drums are in the basement so that erection is simplified, with consequent all-round economy.

Boiler Constructional Aspects

Mr. Simonson said in his B.E.P.C. paper that in operating manpower the large unit boiler afforded appreci-

Table 3.—English Electric Turbo-Alternators and Their Steam Conditions since 1944

Year of Completion	Station	Rating MW	Pressure p.s.i.	Temperature deg F
1944	Mexborough	30	600	850
1945	Mexborough	30	600	850
1946	Hayle	15	235	730
1946	Huddersfield	20	350	750
1947	Bolton	31·25	400	800
1949	Canning Town	30	600	850
1950	Clyde's Mill	30	600	850
1950	Stourport	60	1,250	950
1951	Bromborough	50	900	900
1951	Fulham	60	900	900
1951	Blackwall	30	600	850
1954	Drakelow	60	1,500	1,050
1954	Stourport	60	1,500	1,050
1955	Marchwood	60	900	900
1955	Fleetwood	30	600	850
1955	Wakefield	60	900	900
1958	Belvedere	60	900	900
1957	Willington	100	1,500	1,050
1960	Belvedere	120	1,500	1,000 Reheat 1,000
1960	Uskmouth	120	1,500	1,000 Reheat 1,000
1959	High Marnham	200	2,350	1,050 Reheat 1,000

able economies over a combination of smaller boilers of the same total steaming capacity. In the large unit automatic combustion control becomes a virtual necessity in view of the heat flow rate and the consequent magnitude of the losses involved in lack of speedy response to load changes or variation in fuel quality.

Clarke, Chapman & Co. point out that the pressure parts of each steam generator are nearly always suspended either from the boilerhouse steelwork or from an independent structure to allow freedom for expansion in all directions. Access to every part is possible from the platform and stairways which are connected by a common service lift.

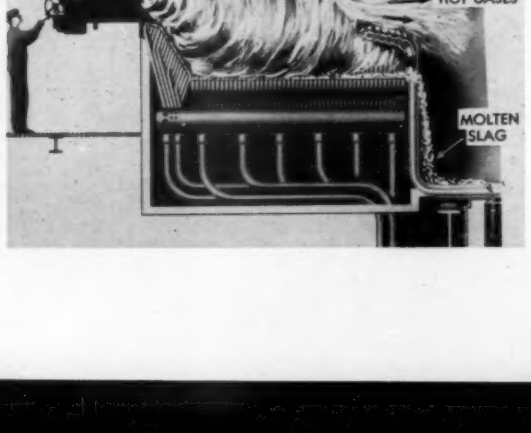
To obtain a clear idea of the evolution of the modern large steam generating unit, it is useful to examine boiler furnace design of the period round about 1928. Stoker firing was general, the furnaces were lined with refractory brickwork, the height from the grate to the first row of tubing was 16ft or less, with sprung refractory arches front and rear. Increased unit sizes up to 100 klb/hr evaporation with attendant high continuous heat release shortened the life of the furnace refractory linings and it was about this time that water-cooled furnace walls of finned or cast-iron blocked tubing first made their appearance in this country.

In his Conference paper, Mr. Dore said that the boilers for the 200 MW units were of the dry bottom type and were one of two basic designs, namely, twin furnace with corner firing and assisted circulation, and divided furnace with front wall firing and natural circulation.

In most high-temperature installations in Britain to-day the superheater and reheater designs aim at minimising the fouling that occurs with coals of high chlorine content. To meet two-shift duty, the superheater surface is proportioned and the burners arranged so that following a six-hour shut-down a superheater outlet temperature not more than 150 deg F below the full rated temperature can be achieved at a steam flow corresponding to the no-load consumption of the turbine and the aim is to pick up full load in a period of 20 min from the time of synchronising the set.

In the line of progress firing by stoker or pulverised fuel could be accommodated until finally the limit of

Fig. 2.—Babcock & Wilcox modern cylone-fired boiler furnace



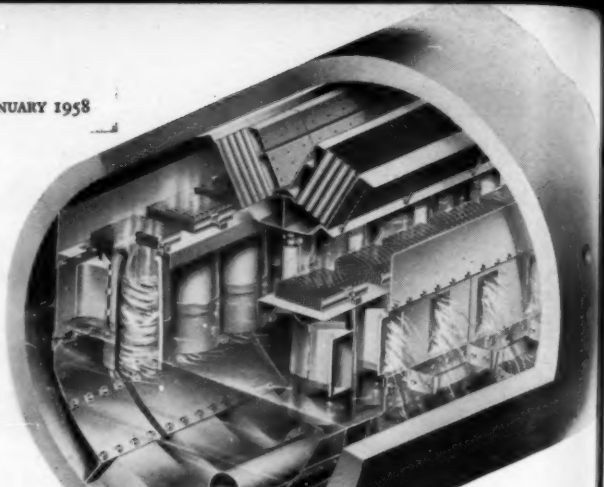


Fig. 3.—Typical Babcock & Wilcox cyclone boiler unit

stoker firing was reached and pulverised fuel became general for sizes above an evaporation of 200 klb/hr.

On the question of pulverised fuel firing Simon-Carves speak with special knowledge. They say that the boiler evaporation, steam conditions and unit generating capacities of Padiham " B " are greatly exceeded by even more advanced stations such as High Marnham. In this connection the point is worth making that the C.E.A.'s willingness to install 275 MW and 550 MW generating sets is a high tribute to the reliability of British equipment.

Babcock & Wilcox remind us that practically all boilers installed in central stations since the war have been fired by pulverised fuel. One reason for this is that there is a practical limit of about 250 klb/hr to a boiler fired by the alternative methods of chain grate or spreader stoker. A further restriction is imposed by the increasing use of " bleeder " regenerative feed heating. When feed temperatures are high economisers by themselves cannot reduce sufficiently the temperature of the flue gases passing to the stack; air heaters must therefore be used. As the temperature of the feed increases, however, so also will the temperature of the air leaving the air heaters; but there is a limit of 300/350 deg F to the temperature at which mechanical stokers can accept pre-heated combustion air.

Without any doubt, say Babcock & Wilcox, the most radical advance in firing techniques in the last 35 years has been the cyclone furnace in which crushed or coarsely ground coal is fed with a certain amount of carrier air into one end of a cylinder formed of water tubes connected with the main boiler circulation. Secondary air is fed in tangentially at high velocity causing a violent swirling action. The excess air is very low, 10 to 15 per cent, with an extremely high heat release and temperatures over 3,000 deg F. Fig. 2 shows a modern cyclone-fired boiler and Fig. 3 a typical cyclone unit.

Comparing conventional dry bottom p.f., wet bottom slag tap and cyclone firing, it may be said generally that with dry p.f. some 80 per cent of the incombustible matter passes through the boiler as dust and has to be extracted from the flue gases before they go to the chimney; in slag tap firing the proportion is about 50 per cent, but with cyclone firing only some 10 to 15 per cent remains unslagged. Thus, cyclone firing results in a tremendous saving in capital cost, not only in the precipitation plant but also in the dust handling and conveying plant.

In the main we have referred to boilers designed for

burning bituminous coal, but there are three other types of fuel being used in this country. First, there are the low volatile coals of which there is a somewhat limited supply. Here, use is made of corner p.f. firing with fairly extensive areas of refractory lining on the walls of the furnace to promote and sustain ignition. Water-cooled furnaces can also be employed with downshot burners producing a U-shaped flame.

Then there is washery slurry of which there are considerable quantities throughout the country. Attempts to burn this type of fuel on a large scale have not been made, but a most promising experiment is being carried out at the Barony Colliery. The two main problems in using this fuel are, first, its handling and, second, its drying before burning; it has a putty-like consistency and so normal methods of storing and conveying are useless for it.

The third type of fuel to which we refer is oil. In 1954-55 the C.E.A. used some 37 million tons of coal and every reasonable estimate pointed to the probability that by 1965 they would require 65 million tons. Thus they had to find an alternative fuel. They entered into long-term contracts with the oil companies and took steps to convert 15 of their largest power stations from coal to oil burning. Shortly after that the Suez crisis demonstrated the unreliability of the Middle East oil supply and led to the Government ordering an immediate acceleration of the nuclear energy power programme, although this was also encouraged by advances in reactor design that made increased output, and potential reduction of capital costs per unit, possible.

Boiler Availability

In seeking to explain the phenomenal increase in the size of boilers we must refer to the work of the Boiler Availability Committee. Before the war boilers were, with some justification, considered to be somewhat less reliable than the turbo-alternators they served. To-day, as a result of the work of the Committee, and the endeavours of the manufacturers, a boiler can, and does, operate for as long a period between overhauls as a turbine. In these circumstances the unit system with only one boiler to serve one turbine became possible with an immediate up-surge in both boiler sizes and steam pressures and temperatures.

When pressures first began to increase rapidly some uncertainty was felt as to the limit at which natural circulation in a boiler could be retained. Natural circulation depends on the fact that the density of the water in the downcomer pipes outside the furnace is greater than the density of the water/steam mixture in the risers forming the furnace walls or the convection circuits of the boiler. Upon approach to the critical pressure, at which the density of steam and water are the same, the density difference causing circulation becomes less and less. It is realised that there is a limit to the pressure at which natural circulation is safe, so that beyond this limit forced circulation must be employed. Once forced circulation (Fig. 4) is adopted, however, the need for separation of the steam from the water is eliminated and consequently the need for a boiler drum.

The exploiting of radiant heat has continued and furnaces are now provided with close pitched tubing. With high-head natural circulation boilers the 3¼in o.d. tubes are spaced $1\frac{1}{8}$ in apart and backed by plastic refractory and insulating slabs finished by a hard-setting composition for the metal casing, making a total of 6in from the centre of the tube to the outside of the covering.

Most of the big steam generating units operate with natural circulation, the present trend being to use external downcomers or feeders to the furnace bottom headers. High-head large tube boilers will operate successfully, say Clarke Chapman, on natural circulation up to pressures of 1,000 p.s.i. where the steam and water densities are about 2·28 and 46 lb/cu ft, respectively. In the region of 1,500 p.s.i., with steam and water densities of 3·7 and 42, respectively, it would be advantageous to have controlled circulation. The critical pressure of steam is about 3,200 p.s.i., with equal density of steam and water of 20 lb/cu ft. With this condition no flow takes place; therefore forced circulation must be adopted. Usually a sub-critical pressure is adopted with once-through boilers.

La Mont boilers operate on controlled circulation, one or more circulating pumps drawing water from the steam and water drum and forcing it through the heating system and making two or more circuits.

Larger Generating Sets

It is a logical step from larger boilers to larger turbo-alternators although, in fact, the latter were developed first, and here we must first refer to the 200 MW English

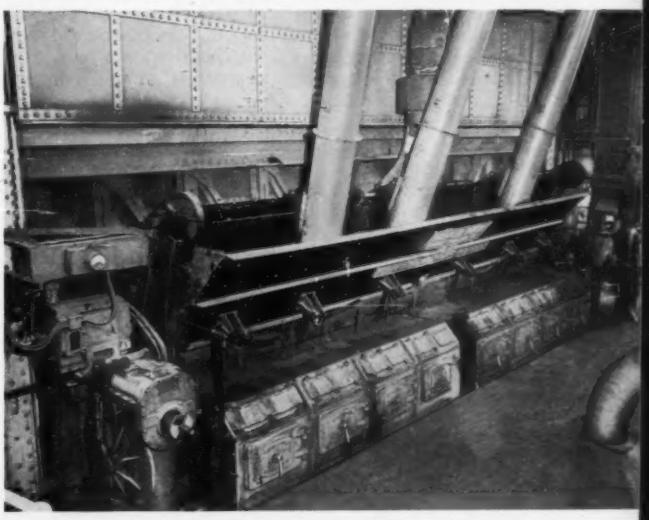
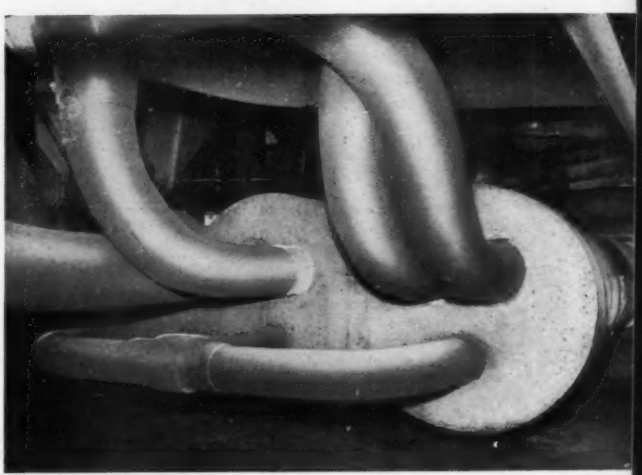


Fig. 4.—One of the forced circulation boilers at Brimsdown power station: 1,900 p.s.i. and 923 deg F ; main drums on basement floor below firing floor



Electric sets, five of which are being installed in the first 1,000 MW station in Europe, namely, High Marnham. These machines are coupled in line, run at 3,000 r.p.m., operate at 2,350 p.s.i. and 1,050 deg F, reheating to 1,000 deg F, and exhausting to 28·7in Hg vacuum. The alternators are of the direct hydrogen-cooled type, generating at 16·5 kV, with a rated gas pressure of 30 p.s.i.

A design described by Mr. V. Easton in the *G.E.C. Journal* not only provides for the most efficient dissipation of the loss in the rotor windings, but also a sound practical construction which has many advantages over the normal method of winding. It permits an appreciable reduction in frame size to be made and raises the output of a single unit running at 3,000 r.p.m. to a figure in excess of 200 MW. The weight of the stator is appreciably reduced and since this is usually the heaviest lift and determines the size of the turbine room crane, not only is the latter less expensive but the building costs are lower. Another important point is that the length of the set, including space for rotor withdrawal, is also reduced. Furthermore, transport problems are eased and the maximum output of the unit which can be conveyed to the site in one piece is raised, so deferring the time when it may be necessary to build and wind a stator on site. In most cases it is possible with direct cooling to use a rotor of a smaller diameter and this reduces the mechanical problems and facilitates the selection of materials.

With further reference to the 200 MW set, Mr. Doré says in his Conference paper that the rapid developments which have been taking place in design and production have made it difficult to establish the relative economics of steam conditions with any certainty and choice in this respect had to be guided by the general principle that the higher the unit rating the higher the steam conditions economically justified. Detailed consideration of the whole question suggested finally the adoption of initial conditions of 2,350 p.s.i. and 1,050 deg F, with one stage of reheat, the inlet conditions following reheat being 426 p.s.i. and 1,000 deg F.

Reheating

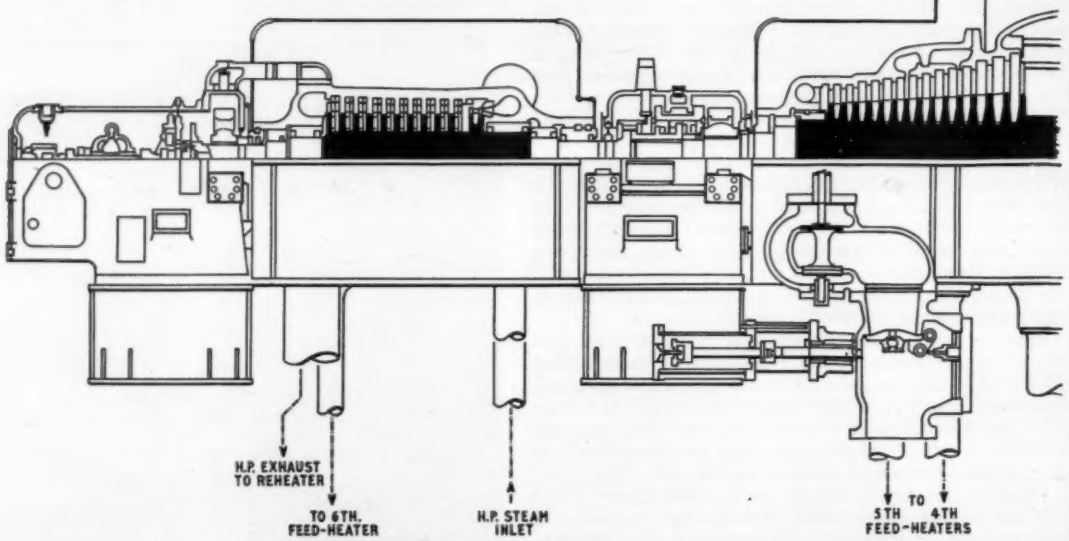
It is necessary to stress the fact that reheating is not new in this country, but that there was a lapse of 20 to 30 years before its revival. One of the first important reheating installations was at Dunston where the conditions were 600 p.s.i. and 800 deg F, but we recall at random Brimsdown with 1,900 p.s.i. and 932 deg F.

In his paper at the World Power Conference in 1956, Mr. P. D. Morris (B.T.H.) said that recent developments in turbine governor and control gear largely concerned turbines operating on a reheat cycle. At the same time there have been many improvements in the governing mechanism for non-reheat turbines. Increase in energy per unit volume of steam, the increasing ratings and the lower inertia of the rotors per unit output necessitates the provision of governor gear having a high rate of response. The lack of this quality may cause undesirable interaction between prime mover and governor.

The aim for higher cycle efficiencies, writes the Superheater Company, has resulted in the increased use of reheat with reheat temperatures of 1,000 deg F and above. In boilers for 120 MW sets the high degree of reheat has been achieved as a result of convection heat transfer to a reheater placed in the gas path between the high-temperature secondary superheater and the primary superheater sections. The necessary gas temperatures at the reheater have been obtained by an increased use of radiant heat transfer in the superheater. In reheat boilers for larger units a twin furnace arrangement has been employed having primary superheater surface in each furnace but with high-temperature superheater sections in one furnace only and reheater surface in the other.

Mr. Dore refers to investigations which were started into the potential gains to be obtained from the use of reheat. A major obstacle in earlier reheat installations with more than one boiler per turbine has been eliminated by the development of the very large boiler and, with it,

Fig. 5.—Constructional arrangements of 120 MW three-flow reheat turbine (B.T.H.)



the unit boiler-turbine technique. To establish development in this direction on a sound footing no attempt was made initially to obtain any substantial gain in thermal efficiency over the straight cycle, the stop-valve conditions of 1,500 p.s.i. being maintained, but with the initial temperature limited to 975 deg F, with reheat to 950 deg F. In 1951 a 100 MW unit of this type was developed for installation in Ferrybridge "B" in 1956 as the first in the station of three such units.

Mr. Robson says that the widespread re-introduction of the reheat cycle has been responsible for some interesting problems in design. The re-admission of high-temperature steam, for example, has a direct effect on the design of intermediate pressure cylinders of large reheat machines. At the inlet both casing and rotor may be subject to almost the full reheat temperature; at the exhaust end where temperatures are more moderate the blade lengths may be appreciable and the rotor material must have good physical properties to deal with the centrifugal stresses involved. There are several ways of dealing with this problem: inserted nozzle boxes could be used at the inlet and a first stage with a large heat drop and a two-row velocity wheel would reduce the temperature in the cylinder to reasonable proportions although there would be a slight loss of efficiency.

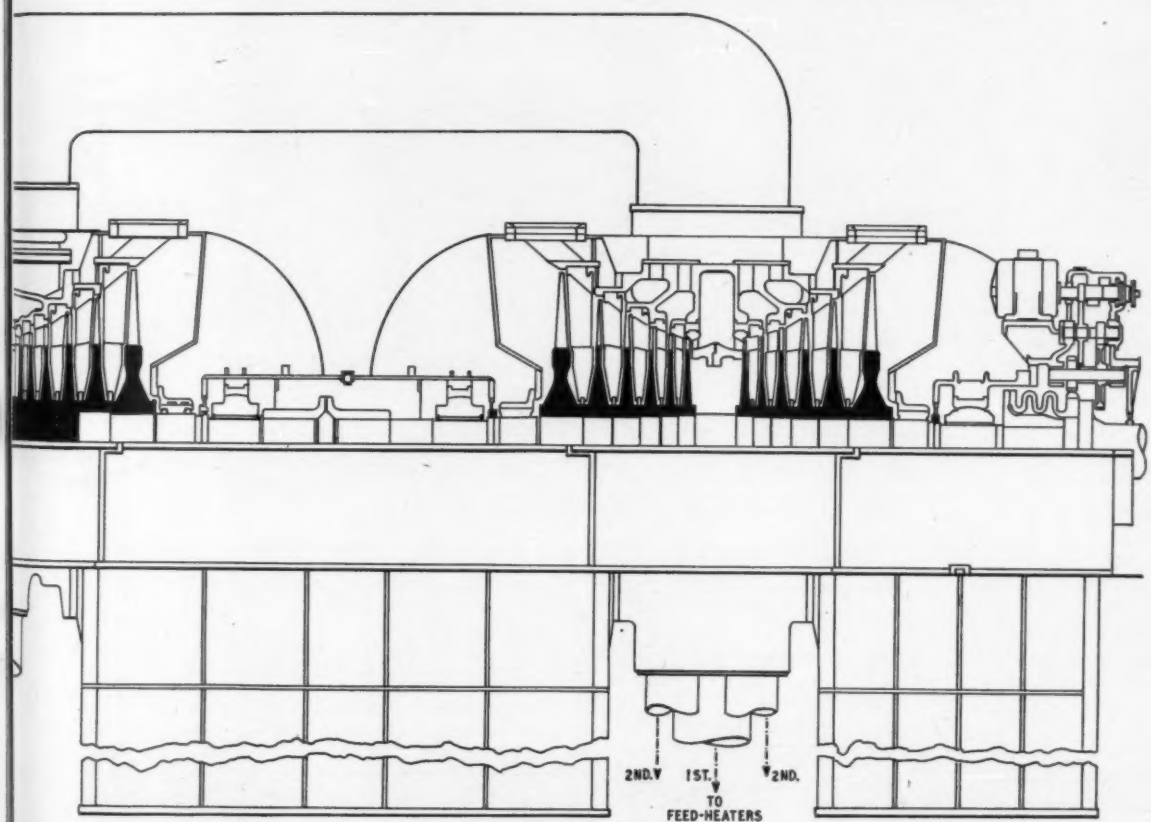
As we have already pointed out, turbine operation in Great Britain is on the two-shift system in which machines are started up and loaded in the morning and shut down at night; even 200 MW units are specified to be capable of this duty. The unit station is, of course, very closely associated with this method of operation and, if our memory serves us correctly, Little Barford, now in the Eastern Division, was the first station of this character to be erected in this country. Then came Llynfi and, making a much bigger stride, there is the Keadby 360 MW station and the High Marnham 1,000 MW station yet to be (Fig. 6).

Alternator Cooling

With the demand for larger outputs from individual generating units manufacturers are now resorting to direct cooling of the rotors of alternators to improve the rate of dissipation of heat from the rotor windings. Hydrogen was introduced because it has better heat transfer qualities than air, but the building of such machines was deferred until after the war, the first being installed at Littlebrook "B" in 1949. The earliest of these machines were designed for normal operation at 0·5 p.s.i. hydrogen pressure. By modern standards they were large and heavy but their reliability proved to be very high and they showed efficiencies of 98·5 per cent, compared with about 97·5 per cent for air-cooled generators of similar rating.

The essential feature of the G.E.C. direct-cooled alternator is the use of straight rectangular tubes for the slot portions of the rotor windings ventilated on a separate circuit from that of the stator, the hydrogen being circulated through the tubes by a centrifugal impeller mounted on the outboard end of the rotor.

The development of the hydrogen-cooled generator, Mr. Dore told us, had reached a stage where the rating of 100 MW could be achieved without the stator weight exceeding the maximum of about 150 tons permitted by the authorities for transport by road, while experience in



the design of the prototype 60 MW units had shown that steam conditions of 1,500 p.s.i. and 1,050 deg F could be achieved without incurring excessive costs (Fig. 7).

Water cooling of the alternator stator represents a further step in the development of improved dissipation of heat, and in this connection we may refer to the 30 MW development at the Bold station which has now been in operation for more than a year (Fig. 8). It was installed by Metropolitan-Vickers and operational results are eagerly awaited.

Main Plant Influences Auxiliaries

In the foregoing we have shown broadly how the design and production of major plant has been influenced by general economics and other over-riding conditions. In turn, the more modern plant thus produced has exercised an influence on all types of station auxiliaries.

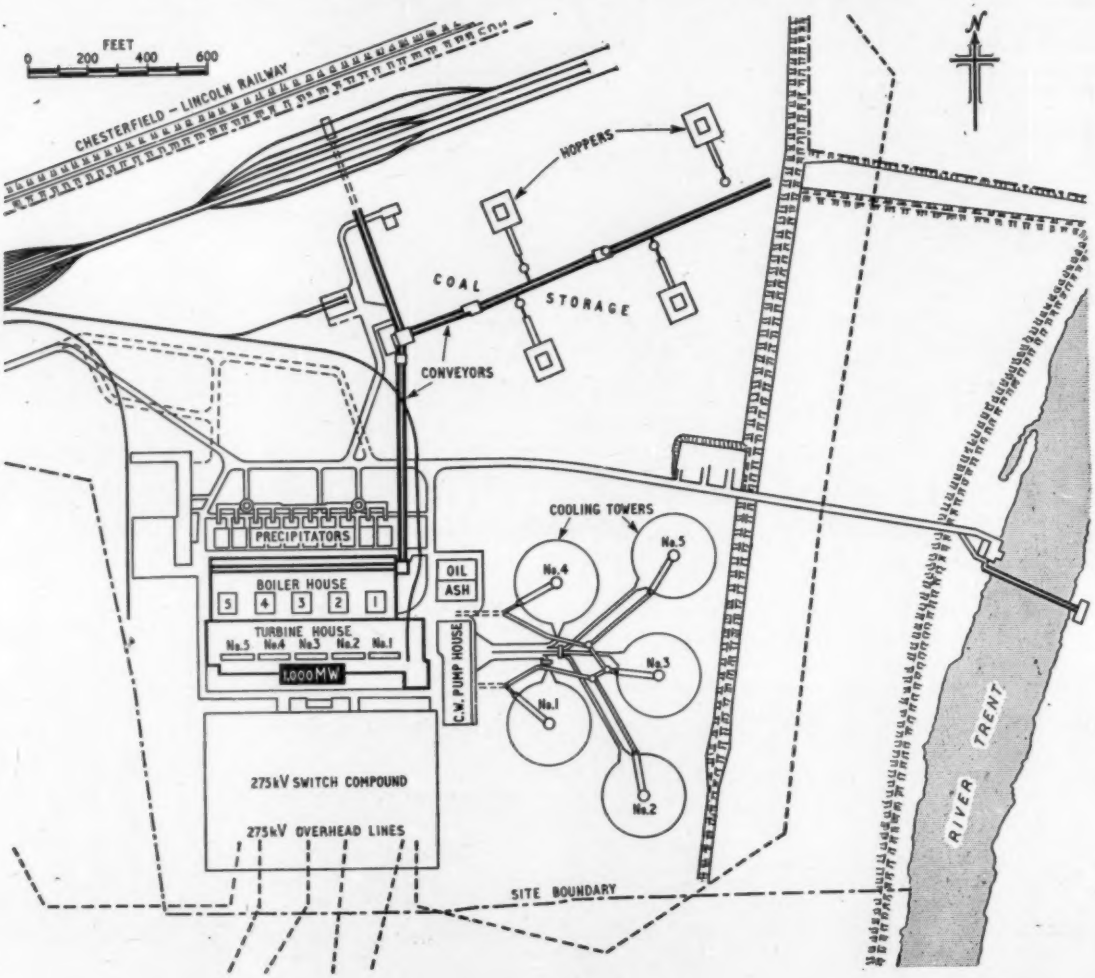
First, there is the question of control of both boiler and generator plant. The Superheater Company says that automatic control of steam temperature, which was quite common in 1945, has now become essential owing to the use of high temperatures and is always included for reasons of superheater safety as well as turbine efficiency and safety. Increases in the unit size and working pressure have resulted in the use of interstage spray desuperheaters instead of the non-contact desuperheaters previously employed for steam temperature control.

George Kent, Ltd., have drawn our attention to the automatic control panel at the Bankside power station where there are oil-fired boilers, each having an m.c.r. of 375 klb/hr at 950 p.s.i. and 925 deg F, serving two 60 MW turbines. Automatic control panels for two of the boilers in the Hackney "B" power station have an m.c.r. of 300 klb/hr at 625 p.s.i. and 860 deg F. In the Marchwood power station, which is arranged for unit operation, each steam generating unit is provided with a combined boiler and turbine control panel with a separate transmitter panel. It has become common practice to measure the oxygen content rather than the CO_2 content of the flue gases in order to obtain a better knowledge of combustion conditions.

Bailey Meters & Controls remind us that they developed three-element feed-water control many years ago and that this was installed on the high-pressure boilers (1,248 p.s.i.) at the Dagenham works of the Ford Motor Company.

Dewrance & Co., Ltd., have mentioned new designs in boiler mountings, namely, the external high- and low-water alarm, the installation of which eliminates the necessity of shutting down the boiler for the inspection

Fig. 6.—High Marnham will be the first power station in this country to have a capacity as high as 1,000 MW

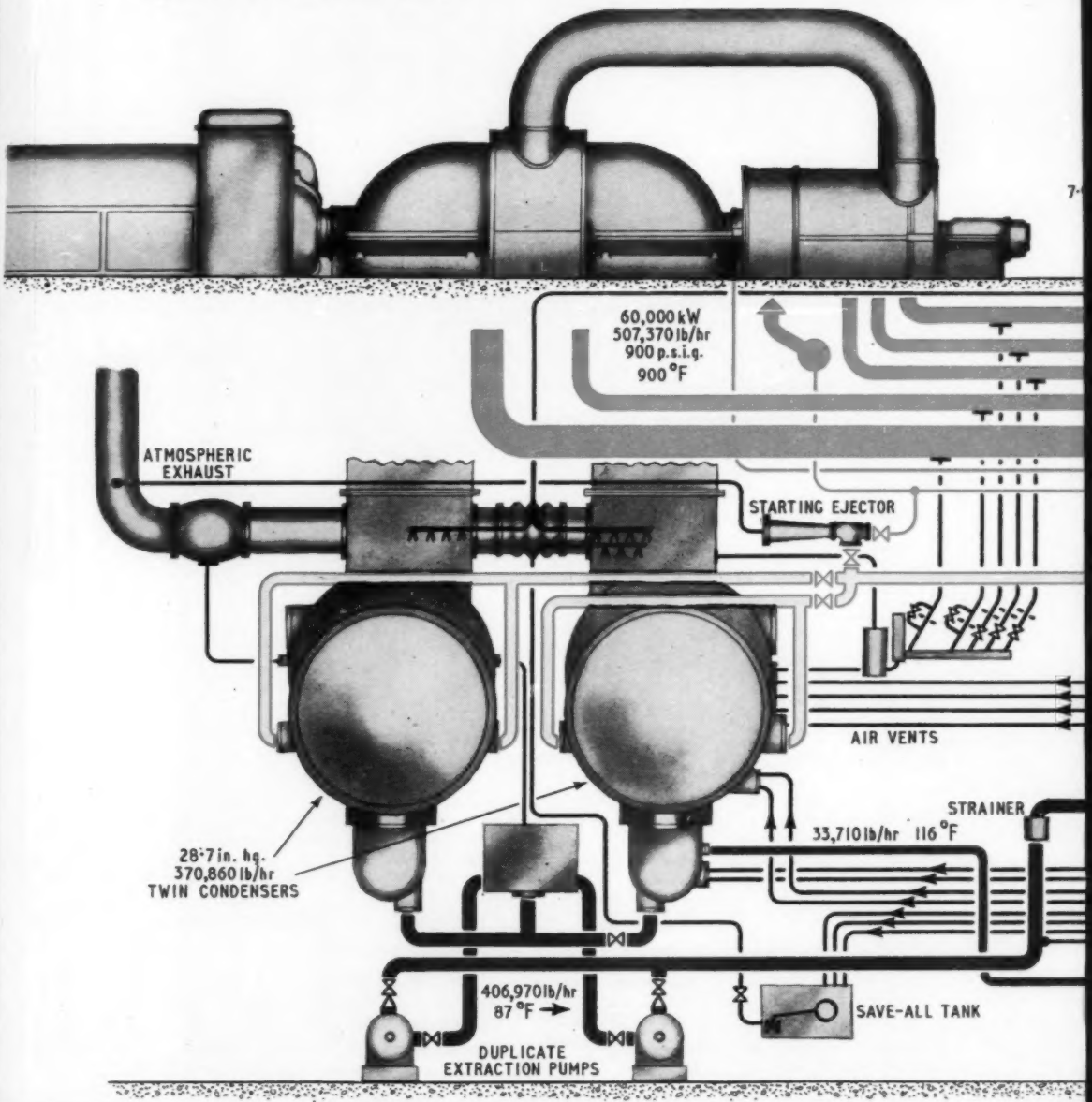


ARRANGEMENT OF FIVE-STAGE REGENERATIVE FEED HEATING

THIS diagrammatical illustration is typical of the equipment suited to a standard 60 M with complete figures for flow pressures and temperatures to indicate a typical balance a plant rating. Such a system is self-regulating with changes of load. The plant is working in with a 60 MW m.c.e.r. turbo-alternator set produced by the General Electric Co., Ltd. Th designed to run at 3,000 r.p.m. with steam at 900 p.s.i.g. and 900 deg F, and with an absolute ba of 1·3in Hg.

The condensate is pumped from the condenser successively through the air ejector drain cooler, No. 1 l.p. heater and the gland steam condenser; it then passes through No. 2 and a high-level direct-contact de-aerator (which is the third stage of heating); then to the pumps before being passed through No. 1 h.p. and No. 2 h.p. heaters; and subsequently to at approximately 385 deg F.

Similar systems to that illustrated are provided with reheat turbines with ratings of 120 t the number of heaters being increased to six, seven or eight to suit the rating and the desire temperature. Alternative feed heating systems can be provided to suit split-pumping or sing arrangements of boiler feed pumps.

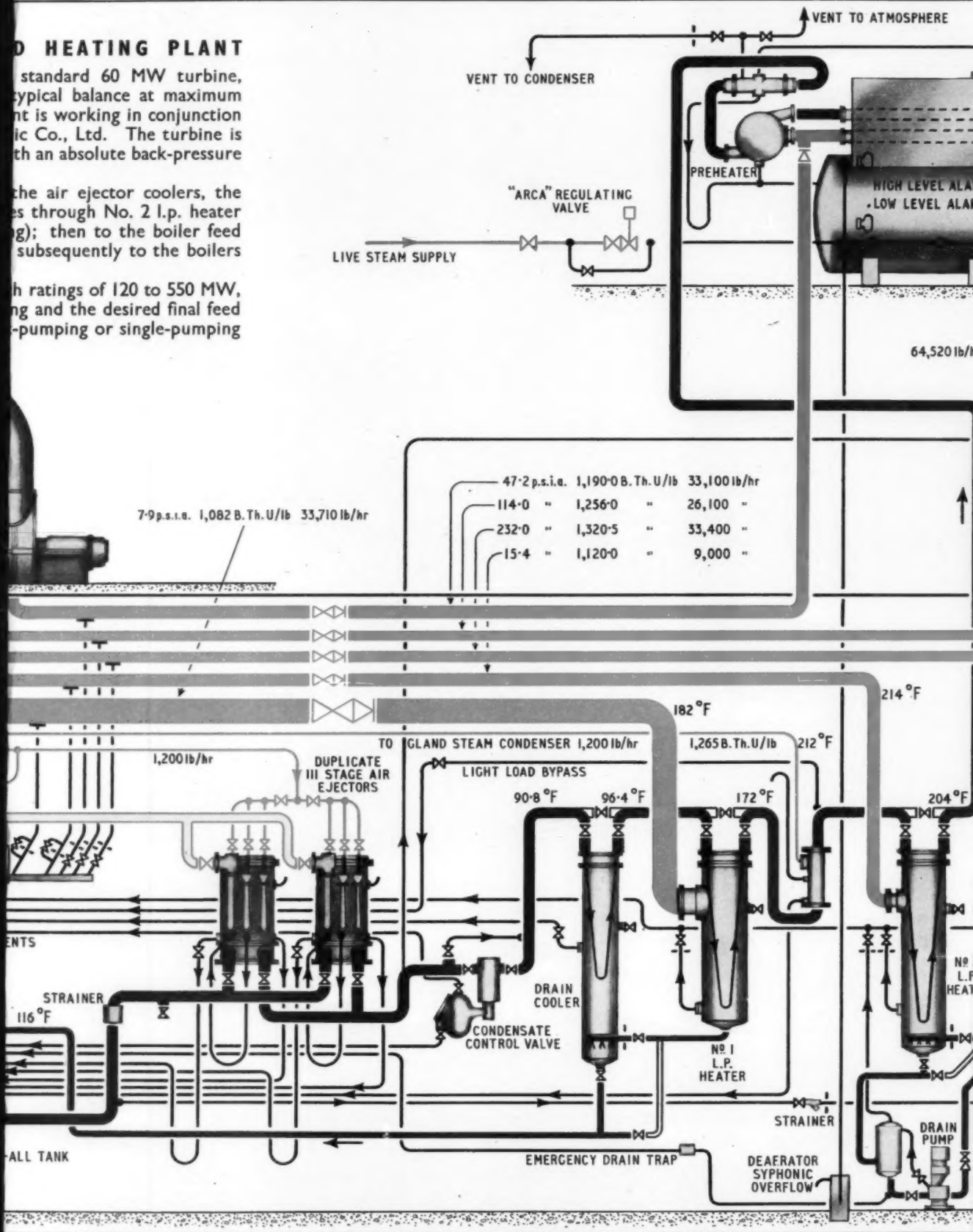


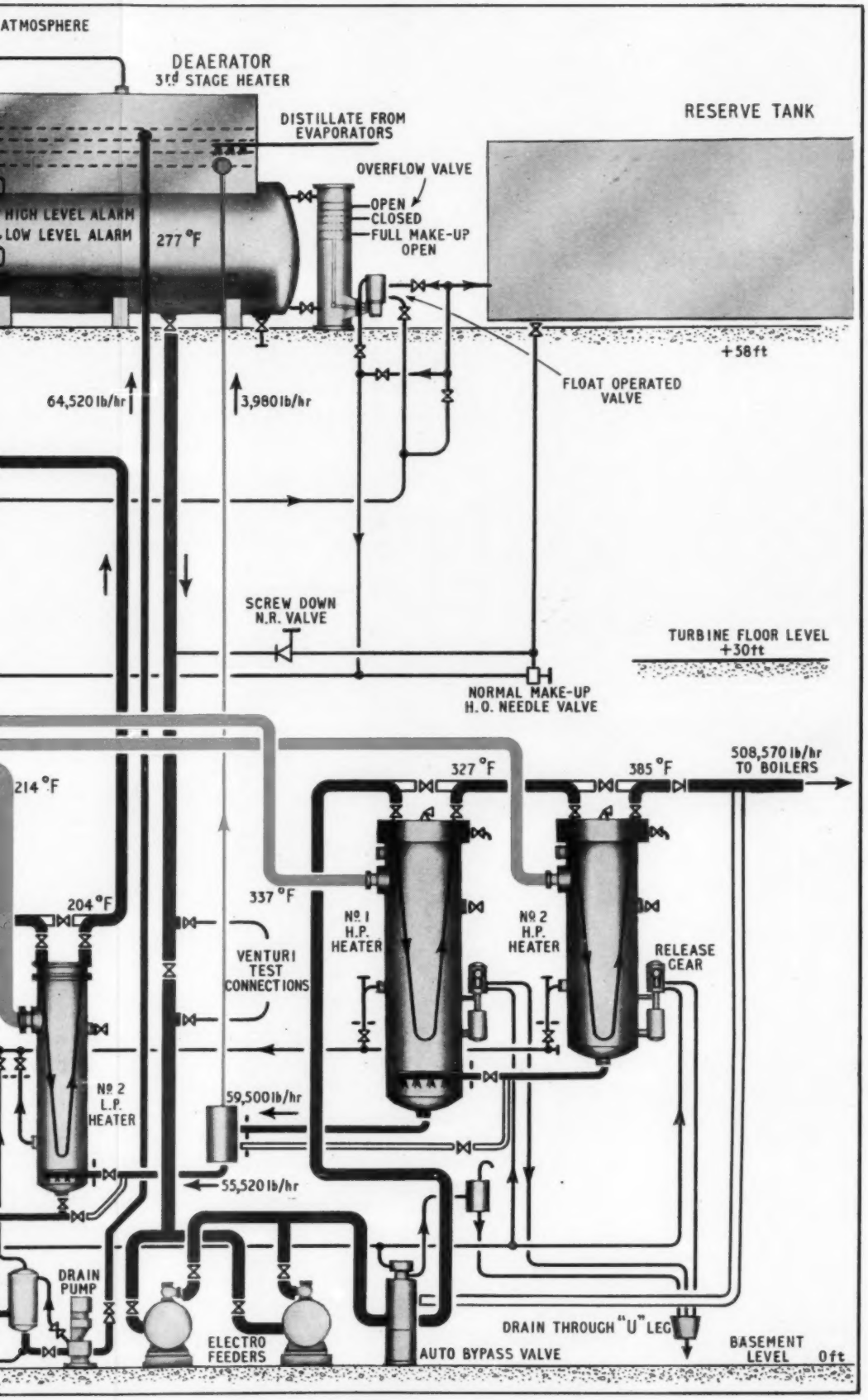
D HEATING PLANT

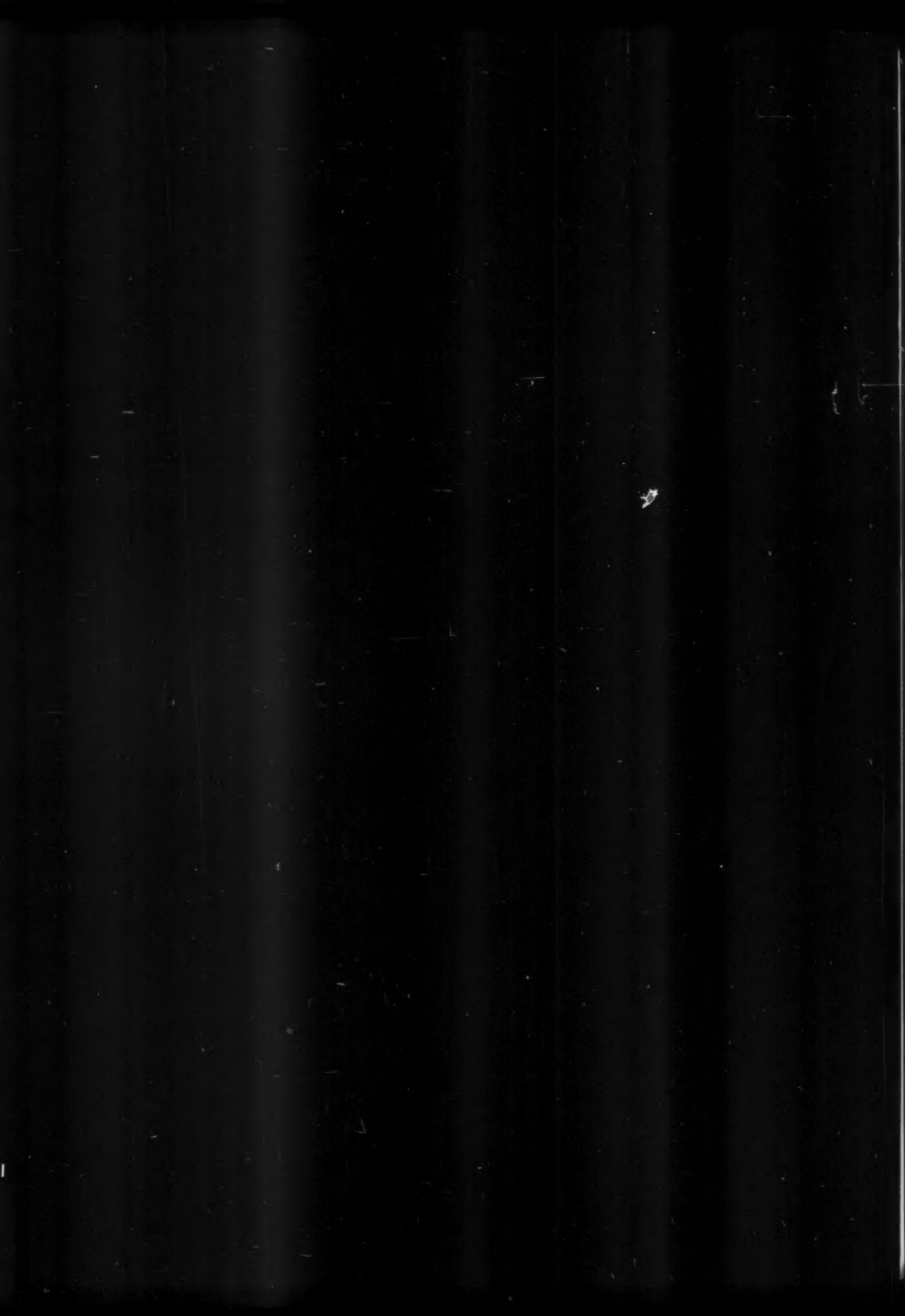
standard 60 MW turbine,
ypical balance at maximum
nt is working in conjunction
ic Co., Ltd. The turbine is
th an absolute back-pressure

he air ejector coolers, the
s through No. 2 l.p. heater
g); then to the boiler feed
subsequently to the boilers

h ratings of 120 to 550 MW,
ng and the desired final feed
-pumping or single-pumping




ATMOSPHERE
DEAERATOR
3rd STAGE HEATER
DISTILLATE FROM EVAPORATORS
RESERVE TANK
OVERFLOW VALVE
OPEN
CLOSED
FULL MAKE-UP OPEN
HIGH LEVEL ALARM
LOW LEVEL ALARM
277 °F
+58ft
64,520 lb/hr
3,980 lb/hr
FLOAT OPERATED VALVE
SCREW DOWN N.R. VALVE
TURBINE FLOOR LEVEL +30ft
NORMAL MAKE-UP H.O. NEEDLE VALVE
214 °F
327 °F
385 °F
508,570 lb/hr TO BOILERS
204 °F
337 °F
Nº 1 H.P. HEATER
Nº 2 H.P. HEATER
RELEASE GEAR
VENTURI TEST CONNECTIONS
Nº 2 L.P. HEATER
59,500 lb/hr
55,520 lb/hr
DRAIN PUMP
ELECTRO FEEDERS
AUTO BYPASS VALVE
DRAIN THROUGH "U" LEG
BASEMENT LEVEL 0ft



of the internal components of the alarm. The company's bi-colour illuminated water level indicator is now a standard fitting for high-pressure water-tube boilers and provides accurate instantaneous readings of the water level at the firing floor level.

As regards instruments, Crompton Parkinson, Ltd., mention their circular scale type which is being used to an increasing extent because a scale length of 6½in can be accommodated in a 3½in dial, and a large number of circuit values can be accurately displayed in a small compass.

Keith Blackman, Ltd., say that it is common knowledge that the amount of air required for perfect combustion is extremely critical—too much or too little will affect both boiler efficiency and the amount of smoke produced, the latter point being of particular importance in view of the recent Clean Air Act. This presents the fan manufacturer with the problem of providing mechanical draught fans capable of a fine degree of volume control and of high efficiency with a view to reducing costs.

Drysdale & Co., Ltd., are concerned with the design and supply of circulating water and main extraction pumps which can play a considerable part in improving power station efficiency.

Clyde Blowers, Ltd., refer to the long retracting blower which now forms an important part of all soot-blowing equipment. Because it can be withdrawn completely outside the boiler after soot blowing it eliminates all trouble previously experienced with the distortion of elements which were permanently left in the gas stream.

Electromagnets, Ltd., supply magnetic separating equipment for use in coal handling plant to prevent the ingress of tramp iron into crushing machinery and chain grate stokers. Normally, magnetic pulley equipments and overband separators are suitable for this work.

The Permutit Company says that most new power stations employ ion exchange water treatment plant for the treatment of boiler feed. They have supplied a very large number of such plants, mainly of the "Deminrolit" type which provides boiler feed water of distilled or triple-distilled quality and removes silica.

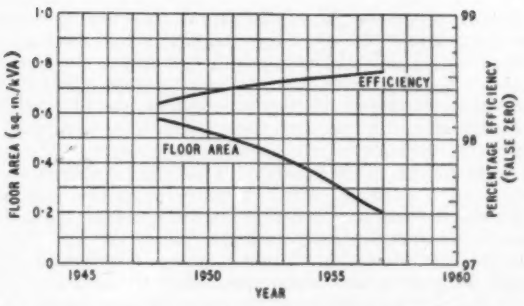


Fig. 7.—Reduction in size and improvement in efficiency of hydrogen-cooled generators (Robson's B.E.P.C. paper)

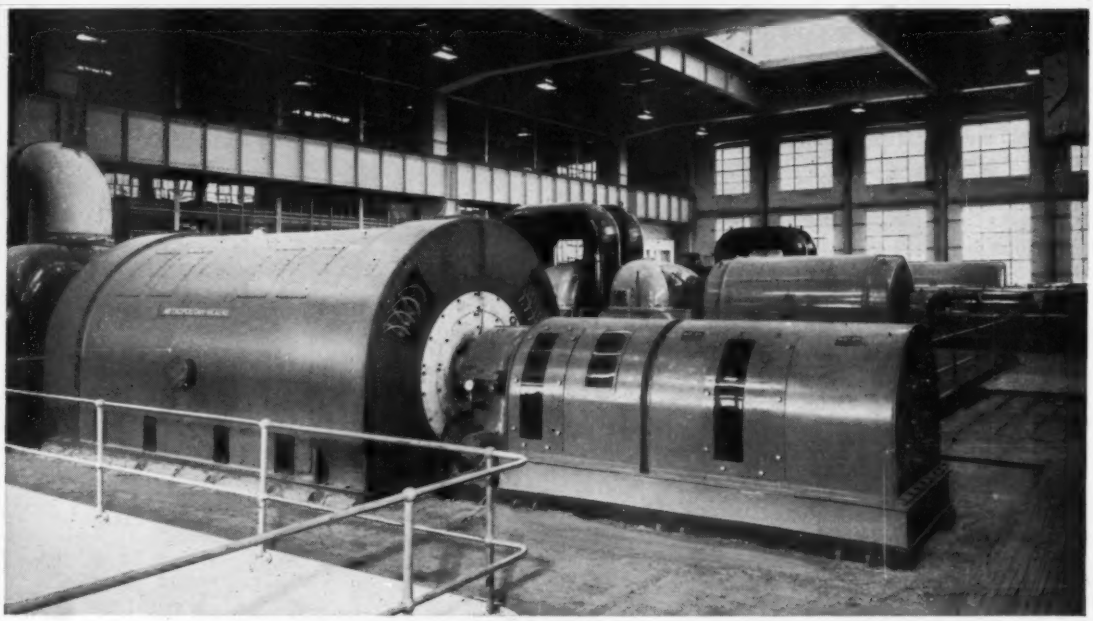
Reavell & Co., Ltd., refer to their general purpose air compressors, and Hopkinsons, Ltd., say that the valve manufacturer has been particularly affected by the much higher pressures and temperatures that became general after the war, and new factors of design and metallurgy have had to be taken into account.

Laurence, Scott & Electromotors, Ltd., believe that the variable-speed a.c. motor, because it can give stepless speed control over any desired range under the influence of automatic equipment actuated from the combustion control instrumentation, has made a material contribution to generation efficiency. During the last decade the size of auxiliaries has steadily increased and motors of 1,000 h.p. with closed air circuit construction and heat exchanger cooling are now commonplace. The company can provide N/S motors up to about 9,000 h.p. for the drives of such auxiliaries as CO_2 blowers in nuclear power stations.

Switchgear Progress

Referring to main switchgear Ferguson Pailin, Ltd., consider that the outstanding achievement of this country's

Fig. 8.—Water-cooled generator at the Bold power station



power programme during the last decade has been the development of the 275 kV supergrid. Air-blast circuit-breakers capable of dealing with this high voltage are now installed at a number of power stations. The first e.h.p. air-blast switchgear to be commissioned in this country more than ten years ago was the company's 132 kV type "Duo-Blast" circuit-breaker at Barrow. A new conception of the application of air-blast breakers was introduced at the Carmarthen Bay power station where circuit-breakers and isolators, normally associated with outdoor substations, were adapted to indoor use. The increase in generating capacity has been reflected on the 132 kV grid to the extent that whereas ten years ago the fault level envisaged was of the order of 1,500 MVA, it is now about 3,500 MVA; some manufacturers have catered for the possibility of a future increase in the fault level to 5,000 MVA. Ferguson Pailin, Ltd., claim that they were the first British manufacturers to produce a bulk oil type of circuit-breaker capable of handling this.

A. Reyrolle & Co., Ltd., say the most distinctive characteristic of post-war power station switchgear is the use of air-break circuit-breakers for both the medium and higher voltages. The medium voltage is standardised at 415 V, three-phase, four-wire, and is used for all the auxiliary lower h.p. motor services and the general lighting, heating and power in the station. In addition to the circuit-breakers controlling the interconnecting circuit and the heavier current motor circuits, switch-fuses and contactors for the lower current circuits are often built into the same switchboard. The circuit-breakers are of the single-break hinged-blade design, usually with arc chutes of refractory insulation suitably disposed to lengthen the arc in a zig-zag path and fitted with cooling plates at the top to prevent the heated ionised gases from re-establishing the arc outside the chute (Fig. 9).

Table 4.—Ferranti Three-phase Generator Transformers supplied since 1946

Year	Station	MVA	Voltage (kV)	Type
1946	Cliff Quay, Ipswich	54	11·8/134	OFW
1947	Carrington, Manchester	75	11·8/132	OFB
	Braehead	58·5	11/134	OFW
1948	Bankside	66	15/70	OFW
	Deptford East	57	11·8/66	OFW
1949	Battersea	87	11/66	OFW
1951	Marchwood	72	11·8/141·6	OFW
	Acton Lane "B"	32	11·6/22	OFB
1952	Ocker Hill	36	11·8/35·4	OFB
	Northampton	36	11·8/35·4	OFW
1954	Bold "B"	72	11·8/141·6	OFW
	Elland	72	11·8/141·6	OFW
1955	Blyth "A"	145	13·8/70·8	OFW
1957	Blyth "A"	145	13·8/304·3	OFW
	Willington "B"	225	15/295	OFW

The circuit-breakers are mounted in sheet steel cubicles which are ventilated to permit the arc gases to be dispersed and are designed to be vermin proof. The h.v. auxiliaries generally operate at 3·3 kV, but with the increase in machine rating the auxiliaries are also increased in size and although at present there are only a few stations using 6·6 kV it is expected that this will become the usual future voltage. The rating has hitherto not usually exceeded 150 MVA, but the increasing size of stations and the standby interconnection are tending to raise the fault rating to 250 MVA at both 3·3 kV and 6·6 kV, while 350 MVA at 6·6 kV is also visualised as the next step in development. The Ferguson Pailin type ASB 37 has been designed to meet that need; it embodies several unique features such as integral earthing which can be carried out on both the feeder and busbar side without the necessity of moving the circuit-breaker truck. This also applies to the isolation of the circuit-breaker.

Transformer Developments

Much the same may be said about transformers with regard to classification. Ferranti, Ltd., have sent us a list of orders received for generator transformers since 1946 for operation on the British grid system (Table 4).

Until about 1953 the maximum size of generator in use was rated at about 75 MW and for these the company was called upon to supply transformers up to 72 MVA rating. At about this time the first 100 MW and 120 MW sets were ordered and contracts for transformers for use in conjunction with them were placed. While transformer outputs have increased in step with the increase in generator ratings so also have the operating voltages.

The vast programme of post-war power station construction carried out by the C.E.A., say the Hackbridge & Hewittic Electric Co., Ltd., has naturally led to a tremendous demand for generation and transmission transformers. The company has supplied generator transformers in sizes up to 88,750 kVA of an aggregate capacity of well over a million kVA, while station and auxiliary transformers have been installed in twelve new stations. In addition, many more transmission transformers in sizes up to 120 MVA at voltages of 275 kV have been commissioned (Fig. 10). Artificial cooling is employed in all these station and transmission transformers; some of them have forced circulation of the oil through a separate water-cooled external system, and others employ forced circulation of the oil through a separate external system cooled by air blast.

The Electric Construction Co., Ltd., have been responsible for some of the transformers for Hams Hall and other C.E.A. stations, for the large circulating water pump motors for Ince power station, and for the boiler-house motors at Ferrybridge.

A necessary adjunct to power station operation are the

Fig. 9.—Typical 3·3 kV auxiliary air-insulated switchboard with air-break circuit-breakers (Reyrolle)

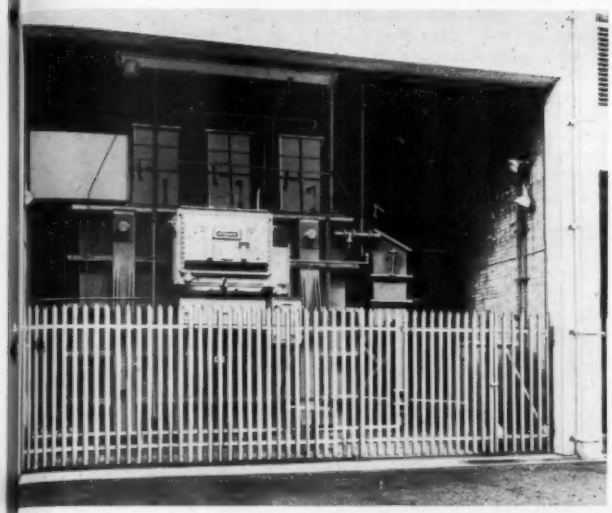


Fig. 10.—One of the three 88,750 kVA 12·5/134 kV three-phase Hackbridge transformers at Barking "C" power station

power cables for the station itself and those for distribution. Cables for a working voltage of 132 kV are now common and single-core cables have generally been used for this purpose. Typical of the cabling in the many power stations throughout the country are the installations at the three Littlebrook stations. The whole of the cabling for the "A" and "B" stations was supplied by Henley's and in 1955 they completed the cabling of three of the 60 MW sets in station "C." A particular feature of the cabling of this station is the provision of a cable tunnel running the entire length of the station under the main transformer bays; this leads to a concrete chase for the 132 kV cables.

British Insulated Callender's Cables, Ltd., refer, in particular, to their work at the Calder Hall nuclear power station. The principal work was the laying of 11 kV cables carrying the output of the station's four 28·75 MVA turbo-alternators. In two cases, single-core cables were taken in trefoil formation to two 500 MVA switchboards and thence to two C.E.A. 30 MVA transformers at the new Calder transformer station, a total run of 240 yd. Similar cables connect these two switchboards to 350 MVA switchboards housed in each of the reactor buildings and supply the thermal reactors with power for their gas pumps and auxiliaries. The output from the other two turbo-alternators is taken by eighteen 11 kV single-core cables laid in six trefoil groups to a 750 MVA switchboard in a new switch house near the Windscale works.

Pirelli-General Cable Works, Ltd., have been awarded a contract worth about £100,000 for the manufacture and installation of four circuits totalling some 5,721 yd of 0·4 sq in single-core copper-conductor 275 kV oil-filled cable at the Drakelow power station. The cables will run between the outdoor type sealing ends at the transformers and similar sealing ends in the switching station. A Pirelli-General 275 kV oil-filled cable has been in operation for over two years at the Central Electricity Authority's testing station at Staythorpe.

Electrostatic Precipitation

The increase in capacity of steam generating units called for a revision of previously accepted ideas on chimney grit emission and naturally manufacturers of electrostatic precipitation plants have given special attention to this problem. Grit collecting efficiencies of 96-97 per cent were considered reasonable before the war, but with the increase in fuel consumption of the largest boiler units the collecting efficiency was raised to 99·3 per cent in order to meet a specified grit emission of 0·1 grain per cubic foot. The dust collecting plant being installed at the new High Marnham power station by the Sturtevant Engineering Co., Ltd., is designed to comply with this specification.

The quality of coal supplied to power stations has steadily deteriorated over the last few years and has added further problems of corrosion and "difficult" dusts. Precipitator manufacturers realise, however, that these problems are here to stay and extensive research and development now in progress points to a satisfactory

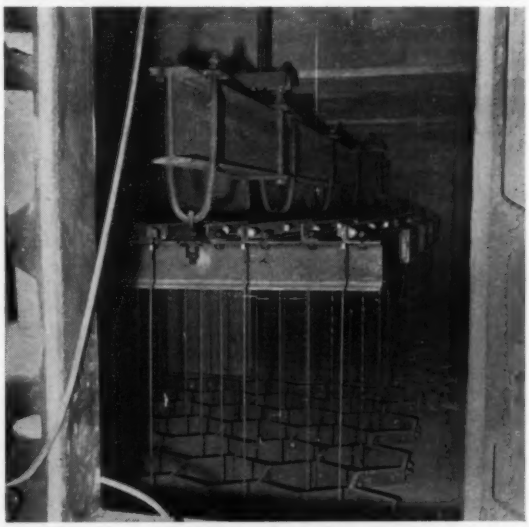


Fig. 11.—With the increase in fuel consumption the collecting efficiency of electrostatic precipitators has been raised to a very high figure

solution of these difficulties. In a brochure, which has been sent to us by Lodge-Cottrell, several modern power station installations are described. The efficiency tests on the precipitators at the Roosecote power station showed that less than one-fortieth part of a grain of dust was being emitted with each cu ft of gas (Fig. 11).

Hydro-Electric Aspects

In Great Britain before the war the hydro-electric capacity for public supply was 85 MW with 298 million

Table 5.—Nature of Hydro-Electric Development

Type	MW	Millions of kWh per annum
Base Load ...	28	196
Intermediate ...	429	1,147
Peak Load ...	253	226
Total ...	710	1,569

kWh average annual production. Since the war the amount of plant installed has been 625 MW (1,265 million kWh), so that the total is now 710 MW and 1,563 million kWh. The average annual load factor of stations ranges from 10 to 60 per cent, the choice of load factor being influenced by the characteristics of the scheme and the requirements of the load. Many of the sites in Scotland

have been suitable for supply of peak energy at relatively low load factors. Table 5 shows how the development has been divided into different classes.

This plant is installed in a number of main hydro-electric stations with generators ranging in size from 40 MW down to 5 MW. There are also smaller stations with machines of from 2·4 MW downwards as well as numerous smaller compensation water sets at dams.

There has been no radical change in water turbine plant or layout, but there have been advances in technical design and construction. Apart from matters of detail, the principal change has been in the increase of heads at which Francis and Kaplan type machines now operate. The highest head Francis turbines are those at Clachan (40 MW) 965ft, and Sloy (32·5 MW) 910ft. These heads would at one time have required the use of Pelton impulse turbines, but they have been considerably exceeded by higher head Francis installations on the Continent. The highest-head plant in the North of Scotland, so far, is the Finlarig 30 MW machine at 1,362ft.

Stations have been developed in suitable groups, either where sites were close together or, more often, where a co-ordinated development took place in a particular river basin. At present, generating groups with control rooms exist based on Sloy (Dunbartonshire), Errochty (Perthshire), Torr Achilty (Ross-shire), and Fort Augustus (Inverness-shire). One further group is just coming into operation based on Killin (Perthshire) and a further group next year at Shin (Sutherland).

The co-ordination of the generation of all the groups, the running of hydro and thermal plants (the latter at Aberdeen and Dundee), the control of the main transmission system, and the interchange with the South of Scotland Electricity Board are supervised from a central control room at Pitlochry, Perthshire.

Nuclear power generation should be mentioned, although it has no real part in this article which relates to progress in "conventional" power station practice. While Calder Hall is contributing its quota to the grid, a general survey of nuclear power station practice must await the completion of the stations which are now being erected or are projected.

Throughout this article references are made to the Central Electricity Authority as the main generating authority during most of the period under review. Since 1st January all the power stations and main transmission systems have been owned by the new Central Electricity Generating Board.

Nuclear Energy Conference

A PROVISIONAL programme has been issued by the Federation of British Industries, 21, Tothill Street, London, S.W.1, of a Conference on Nuclear Energy which the Federation is convening, to be held at the Grand Hotel, Eastbourne, on 10th and 11th April, followed by a visit to the United Kingdom Atomic Energy Research Establishment at Harwell on 12th April. The chairman will be Sir Claude Gibb, managing director of C. A. Parsons & Co., Ltd.

The programme states that in addition to nuclear power developments in this country, the many overseas orders for British nuclear plant already placed, or at present being negotiated, confirm the belief that this new industry is destined to become a major contributor to the United Kingdom's export trade. Growing numbers of firms and industries still only on the fringe of this development, will benefit, both as suppliers to the nuclear industry and as consumers of its products and by-products. It is important, therefore, that those who control the policies and investment programmes of the fringe industries and firms should have a sound appreciation of the opportunities now opening to them. It is to cater for this need that the Conference (the first of its kind in this country) has been arranged.

Attendance will be limited to 100 members of director status, including twenty-five industrialists from overseas. Leading experts from the United Kingdom Atomic Energy Authority and nuclear power firms will present papers on various aspects of nuclear energy development, and these will be followed by discussions. The papers will be non-technical, and will aim at conveying an understanding of the business potentials and industrial applications of nuclear energy. The conference secretary is Mr. P. J. C. Perry, of the F.B.I., from whom full particulars can be obtained. The conference fee will be £21, which will include hotel accommodation, meals, copies of conference papers and the visit to Harwell, and the closing date for receipt of applications is 15th February.

Post-Graduate Training Grants

THE Department of Scientific and Industrial Research will again offer awards this year for post-graduate training in science and technology—and a new edition of "Notes on D.S.I.R. Grants for Graduate Students and Research Workers" has just been published (H.M.S.O., 1s 6d) giving details of the scheme.

Last year 649 new Research Studentships were awarded by the D.S.I.R. in addition to those renewed for second and third years. Further, 152 of the newly introduced Advance Course Studentships were awarded. In all, 1,453 post-graduate studentships were current at the beginning of the present academic year. It is hoped that this year the Department will be able to make at least as many new awards as in 1957. While the values of these studentships remain much the same as last year, the age limits for students who qualify for increased awards, because of at least two years of post-graduate experience in industry, have been reduced by two years.

Forms of application for studentships are supplied only to senior staff members of departments of science and technology in universities, colleges and other approved establishments. Initial applications for the Research Studentships will be made for a quota of awards for a research school, and individual candidates need not be named until later.

Testing Vulcanised Rubber

"METHODS of Testing Vulcanised Rubber," Part A7: 1957. "Determination of Hardness" (B.S. 903) has been issued by the British Standards Institution, 2, Park Street, London, W.1 (price 4s). This new publication replaces Part 19 of the 1950 issue of B.S. 903. The main differences between the two are (*a*) that the base plate type gauge has now been omitted, and (*b*) a slight alteration has been made in the relationship between the indentations and the B.S. hardness degrees. The latter alteration was made so that the values might prove acceptable to the International Organisation for Standardisation. (Part A7 is, in fact, technically identical with draft I.S.O. Recommendation No. 148.)

The 12-page illustrated publication contains sections on definitions ("Stress," "Strain," "Young's modulus"); a summary and explanatory note relating to the test; requirements for the test piece and the apparatus; and procedure (preparation of sample, conditioning test pieces and samples, method of measurement, number of readings).

It is pointed out that most instruments now in use read directly in British Standard and international rubber hardness degrees, but a special table has been included for use with older type instruments which enables British and international hardness to be quickly derived from the "penetration difference."

Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, W.1. Price 4s.

Selling Electric Fires in America

Results of a Recent Six Months' Tour

By L. G. BETTINSON, D.F.C.*

THIS brief account of a six months' selling tour is not intended to be a market survey. It offers no universal formula for winning dollars and contains none of those vital statistics without which the true market researcher will not venture from one paragraph to the next. It is a purely personal view of the field, or rather of the small furrow in that field which I was attempting to plough.

Our sales attack in the United States succeeded, and I would like to think that it might encourage others, who have not yet reaped their full share of the business available, to send representatives to work out on the spot their own selling method by which to exploit this enormous market. In my opinion there can be no substitute for direct personal contact between the British manufacturer and the American retailer in whose shop his products must be displayed and sold.

The impetus for this visit to 28 of the northern States was our growing belief that the steady flow of orders we had received year by year from our New York agents represented only a fraction of our potential business there. America, it is true, has the habit of central heating, whereas we in Britain have the strongest ties, both practical and sentimental, with the open hearth. Though the products I was selling are based on the hearth tradition, we felt that the importance of this difference in heating methods had been exaggerated. If a market was lacking for electric fires as a source of heat, surely one could be developed for electric fires as a form of decoration. Central heating, for all its efficiency, makes no appeal to the imagination, and Americans are both imaginative and houseproud.

Difference of Approach

Our faith in this line of argument was sufficient to launch the selling tour, but there were moments during the first month when this faith was sorely tried. In both wholesale and retail distribution there is a fundamental difference between the British and American approach. The American retailer does not expect to create a demand, only to supply it. For this reason great emphasis is laid on national advertising and the majority of department stores and shops are reluctant to risk the purchase of goods which they find are not fairly well known to the public.

Because of the high cost of manpower, the time of all American salesmen, wholesale and retail, is very valuable and cannot be spent on promoting the sale of an article for which there may be a great but unknown market. They take the line of least resistance all the time. I was determined to find out whether by going directly to the retailers, large and small, I could sell them the idea of electric log fires and convince their salesmen to the point where they in turn would sell the idea to their own customers.

In this picture Mr. Bettinson is seen interesting an American dealer in his display of electric fires in Cleveland, Ohio

On arriving in the United States I bought a large "Ranchwagon" capable of carrying a representative range of samples, and in the larger cities visited I established displays in hotel rooms. I had some difficulty in persuading potential buyers to come to visit my display and here my Ranchwagon "taxi" service proved very useful. Once the buyers came, however, they were interested, attentive, and occasionally appreciative of the fact that I had travelled so many miles from England to see them. In the smaller towns it was necessary to employ the more conventional method of visiting the buyer and laying out my sample display in his own premises—usually without prior permission.

British Products Welcomed

As an Englishman I received no preferential treatment and had to take my turn with the rest. Apart from that I was given a most friendly reception everywhere. It may interest readers to know that I heard not one word of anti-British sentiment throughout my entire stay in the United States. On the contrary, I was very pleasantly surprised to find that both Britons and British products were very welcome.

As I have said, I was selling a product for which there is no essential demand, since nearly all American homes are centrally heated to a high temperature. On the other hand, quite a large proportion of houses and apartments have fireplaces of some kind, most of them dummies. I was able to persuade dealers and department store buyers that everyone of these fireplaces was a potential home for an electric log fire; that here was a source of business hitherto almost untapped. In my opinion this indicates the best chance that British manufacturers have of securing a share of the American market. There are, of course, many parallel cases such as the small British motor car which is satisfying a demand the local manufacturers did not know existed. I was also pleased to

* Export Manager, Berry's Electric, Ltd.

learn while I was there that a special-purpose small English refrigerator was gaining popularity, there being no equivalent made in the United States.

Not Import Minded

The Americans generally are not import minded and the average buyer is ignorant and apprehensive of the formalities connected with importation. Nevertheless, it is much more economical for the buyer to arrange direct import shipments if he can be persuaded to take them. I found a method of doing this by which I was able to quote a price for delivery to the customer's warehouse without involving him in any of the usual complications. This system has now proved satisfactory in practice and is a method by which British goods can reach American buyers in the quickest and most economical way. If details of this would interest British manufacturers they will gladly be given upon request.

The main conclusion which I have reached as a result of my trip is that a British firm with a saleable product in the United States can best secure a market by using its own specialist salesmen to work the territory as I have done. It is extremely difficult to find an American agent willing to put sufficient energy into the initial promotion of a new product or, for that matter, one with sufficient national coverage. When the demand has been created, as I suggest it should be, by the manufacturer himself, it is very necessary to have suitable distributors to maintain local stocks.

The department stores are large sellers of electrical appliances and have a greater share of sales than they do in this country. Many of these department stores belong to buying groups with offices in New York and sometimes here in London, but this does not mean that the local buyers are unduly influenced by the central buyers. Department store buyers are completely autonomous and make their own decisions about the goods in which they are interested. The mark-up which these department stores and other retail buyers have to apply is much larger than in England. This is due to the fantastically high cost of staff and other overheads, and to a certain extent to the ambitious advertising programmes continually carried on in the local press. Merchandising has been reduced to a science and every square foot of floor space is calculated in terms of potential turnover. Any product which does not sell is drastically marked down and cleared to be replaced by something more acceptable to the public.

The recognised standard of safety is the label of the Chicago Underwriters' Laboratory. Though not obligatory, this label is required by most large department stores and reputable dealers for certain types of electrical appliances. Unfortunately, few British manufacturers appear to have found it worth while to obtain this label.

At the end of my trip I was fortunate enough to be able to claim sales of fires to the value of $295,000, this figure being three times in excess of anything which had previously been done by our agents in a similar period. The amount was made up almost entirely of comparatively small orders taken from retailers through the 28 States visited.

It is worth while mentioning that I received a friendly welcome and also valuable support from the British Consuls in the area in which I travelled. They are waiting and willing to help British representatives of which, I am sorry to relate, I met not one during the whole of my trip.

Electronic Control of Bus Services

A DEVICE has been developed by London Transport to give, at a central control point, a picture of the operation of bus services. This bus electronic scanning indicator (B.E.S.I.) consists of a number of check points along each route at each of which electronic equipment reads the running number of a bus as it passes, and transmits it over telephone wires to a central point, where it is displayed on a panel. When each bus passes the next check point the number will be recorded on another panel and cancelled on the first, so that in effect each panel contains the running number of each bus between the two boundary check points.

A pilot system is now being tried out on the No. 74 bus route. Each bus running number has been coded into a binary number and this has been reproduced on a plate containing "cat's eye" reflectors for each digit, and a corresponding blank for each zero. The plate fits into slots placed on the nearside of the bus towards the front, above the driver's cab. To compensate for varying speeds, the plate is produced in two parts, the upper half being a complete row of reflectors to form a timing base. The lower half is the binary code plate.

The scanning equipment has been erected at the same height as the bus plate either on a post at the pavement edge or, where the side-walk is narrow, on a convenient point on the building line. The sites chosen are places where the road is narrow or its width restricted due to a pedestrian island so that buses must pass within 12ft of the scanner and there is no danger of the scanner being masked by parked lorries.

The light source is modulated by a rotating disc so that all signals other than those provided by the reflectors can be rejected. As each reflector passes the beam of light, the reflected light falls on to a photo-cell, the result being an intermittent flow of current still modulated by the source of light, which is then passed to resonant amplifiers. These reject the effect of all extraneous incoming light. Neither the 3,000 c/s modulation nor the waveform of the resulting signals would be suitable for operating the telephone-type circuits which follow, so that they are passed into pulse shaping transformers where a square wave shaped pulse is produced from each signal from the reflectors. The pulses from the time base are now paired with those of the code by feeding them to cold cathode valves, and when both time base and code valves fire together, relays are operated, thus storing the code so formed.

At the control point, the incoming pulses operate relays which will build up the binary number of the bus, and when completed, will close the circuit, causing the actual running number to be illuminated on the check point display panel.

The separate panels of each check point are so wired that as each number comes up on one panel, the number on the previous panel is cancelled. In addition to lighting the indicating lamp, a recording pen mark can be made on a chart moving forward on a scale of time, which forms a permanent record of the time each bus enters the section, and hence the regularity of the service.

The whole of the equipment has been designed and developed at the Executive's Electrical Testing Section at Wood Lane, under the direction of Mr. T. S. Pick, the chief electrical engineer.

OVERSEAS ELECTRICAL TRADE IN 1957

BRITISH EXPORTERS MAINTAIN THEIR POSITION IN WORLD MARKETS

BRITISH electrical exports in December, as shown in the Board of Trade returns, reached a total value of £17·9 million—£1·5 million more than in the corresponding month of 1956. The month's figure brings the total value of electrical exports in 1957 to £227·2 million, and the increase of over £10 million as compared with 1956 indicates that there was no slackening during the year in the world demand for electrical machinery and apparatus and that despite increasing competition the United Kingdom maintained its position in the world markets. Taking the year as a whole, increases were shown in all the main groups of electrical goods. Generating sets, motors, etc., rose by over £2·5 million, converting plant, mercury-arc rectifiers, transformers, etc., by over £1,000,000, radio and associated equipment by about £600,000, telegraph and telephone apparatus by £3 million and cables and wires by £1,000,000.

Within the Commonwealth, India proved the best market, making purchases valued at nearly £22 million. Australia held second place with £20 million, South Africa

TABLE I.—ELECTRICAL EXPORTS

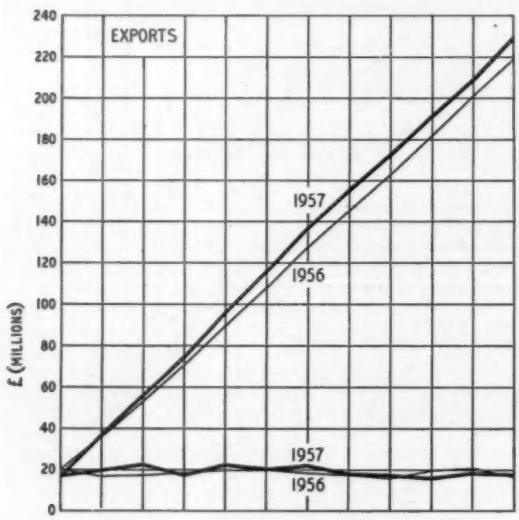
Class	December 1957	Year 1956	Year 1957
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	164,703	1,717,808	1,755,636
Ditto, 10 to 65 kW	123,247	1,846,496	1,996,990
Ditto, 65 to 200 kW	96,204	1,498,647	1,380,138
Ditto, over 200 kW	220,108	3,581,568	3,715,075
Spark ignition engine driven	16,841	358,631	217,981
Steam turbine driven	233,044	1,247,231	1,024,564
Hydraulic turbine driven	—	55,114	168,630
Other prime mover driven	56,877	591,740	300,711
Generators, not exceeding 200 kW	203,102	1,431,741	1,971,204
Ditto, over 200 kW	90,022	1,012,379	1,551,718
Parts of generators	209,701	5,359,052	4,499,790
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ¼ h.p.	152,595	2,327,891	2,337,986
Over ¼ but under 1 h.p.	71,828	647,642	625,085
1 h.p. to 250 h.p.	566,793	5,132,053	5,784,289
Over 250 h.p.	88,340	842,901	1,615,546
Railway, tramway and trolley-bus motors complete and parts of all motors	240,611	1,960,405	2,357,319
Motor starting and controlling gear	294,790	2,916,506	3,854,166
	2,828,806	32,527,805	35,156,828
Converting machinery	25,327	327,237	503,208
Mercury-arc rectifiers	161,481	996,180	1,574,515
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	534,717	11,709,931	6,993,162
Over 7,500 kVA	279,748		3,497,019
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	386,290	3,483,244	4 531,000
Ditto, other	1,083,526	13,436,015	13,884,063
	2,471,089	29,952,607	30,982,967
Primary batteries:			
Lighting	96,024	1,015,498	1,172,128
Radio	290,035	3,144,436	3,028,208
Other	33,385	507,026	473,362
Parts (excl. carbons)	52,248	514,462	670,877
Lamps:			
Filament, exceeding 28 V*	102,021	1,166,750	1,108,460
Ditto, under 28 V*	29,516	368,823	353,533
Arc lamps and searchlights	7,578	217,267	136,205
Discharge lamps, fluorescent tubes, etc.	82,486	878,097	1,113,605
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	22,991	287,407	255,557
All other	270,457	3,060,408	3,476,759
Parts (excluding glass bulbs)	17,237	121,074	171,818
Radio and television transmitters	88,021	1,090,172	748,382
Commercial radio and radar equipment	1,068,648	15,280,101	15,035,740
Domestic radio receivers, mains	82,418	1,586,422	1,271,869
Ditto, battery	46,814	877,110	649,391
Ditto, other (incl. car)	36,497	302,337	344,240
Radiograms	81,661	415,984	454,614
Television sets	122,533	660,963	838,064
Public address equipment	85,933	966,600	1,096,291
Other radio and television app., n.e.s.	52,863	443,903	481,120
Components and parts, n.e.s.	712,453	8,496 462	9,416,217
	2,688,526	33,588,943	34,240,062
Telegraph and telephone installations	727,859	7,581,919	8,799,021
Telephone instruments, separately consigned	216,222	1,750,294	1,908,925
Telegraph and telephone parts	755,750	7,776,324	9,494,749
Line apparatus for long distance commun.	303,793	2,610,251	2,533,007
	2,003,624	19,718,788	22,735,702

Class	December 1957	Year 1956	Year 1957
	£	£	£
Cookers	59,069	903,741	7636,99
Toasters	31,831	380,698	313,440
Other cooking apparatus	32,093	421,628	400,835
Parts and accessories	52,308	943,946	775,311
Space heating appliances	42,752	421,860	449,365
Water heating appliances	26,309	380,498	371,961
Other heating appliances	33,908	393,670	392,025
Parts and accessories	63,464	768,108	691,593
Irons	102,584	1,135,516	985,441
Arc welding equipment, s.c.	48,821	637,543	589,698
Ditto, d.c.	58,311	576,926	574,922
Resistance welding equipment	21,078	192,435	262,048
Electric furnace plant	57,139	725,864	904,278
Magnetos, ignition	19,972	334,815	268,453
Sparking plugs	150,391	2,088,382	1,927,820
Elec. appliances for aeroplanes, n.e.s.	248,736	2,651,056	3,267,975
Ditto, for motor vehicles, n.e.s.	367,355	4,232,473	4,164,983
Ditto, for cycles, n.e.s.	60,313	683,409	660,980
Signalling app. (incl. traffic signals)	101,230	863,411	1,433,445
Instruments, commercial	147,577	2,077,874	1,962,322
House service meters (including parts)	111,448	1,982,558	1,712,252
Electro-medical apparatus (not X-ray)	23,112	499,992	439,658
X-ray apparatus (excl. tubes and valves)	70,566	858,810	875,893
Vacuum tubes	30,387	360,454	484,976
Ceiling fans, complete	47,565	1,234,496	1,184,231
Desk fans, complete and parts of desk and ceiling fans	28,480	467,165	460,651
Vacuum cleaners	126,430	1,696,802	1,770,063
Floor polishers	89,796	907,745	1,054,105
Food mixers	72,266	697,589	679,350
Hair clippers and dry shavers	127,509	968,342	923,142
Other portable appliances	20,168	334,579	306,847
Parts	176,495	1,362,416	1,627,778
Portable elec. tools (not saws) and parts	198,083	2,639,141	2,568,461
Cables and wires:			
Telegraph and telephone, submarine	22,682	2,051,258	4,273,640
Ditto, other	619,347	10,202,991	10,897,298
Cotton, silk or art. silk insulated	25,216	582,566	408,823
Enamel, glass or asbestos insulated	100,006	1,223,377	1,092,880
Paper insulated	553,427	10,547,741	8,728,949
Rubber insulated	549,212	6,469,979	6,450,196
Thermoplastic insulated	229,420	1,776,654	2,371,378
Other	234,112	2,544,096	2,168,449
	2,333,422	35,398,662	36,391,613
Accumulators for motor vehicles	137,213	1,790,220	1,804,914
Ditto, traction	11,500	400,156	301,385
Ditto, radio and other portable	61,492	1,010,229	718,650
Ditto, other	31,587	790,656	358,323
Parts and accessories	75,833	1,144,412	989,791
Elec. porcelain, etc. (incl. insulators), n.e.s.	72,187	1,341,316	1,167,097
Insulating cloth and tape	61,171	719,219	670,145
Other insulating material	91,059	1,173,057	1,147,200
Permanent magnets	54,461	565,865	640,164
Radio, telegraph and telephone testing equipment, n.e.s.	75,798	497,791	797,877
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	24,596	173,934	163,574
Other	324,515	2,717,003	3,733,105
Electrical machinery, n.e.s.	57,892	1,283,635	1,078,629
Electrical apparatus and appliances, n.e.s.	970,264	9,378,739	10,849,556
TOTAL	17,915,874	216,809,333	227,231,961

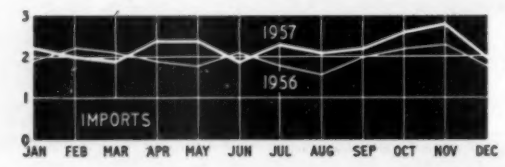
* The figures for 1957 are not completely comparable with those for previous years.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	Dec. 1957	Year ended 31st December 1955	1956	1957
	£	£	£	£
Channel Islands	99,571	874,839	1,022,676	1,175,189
Gibraltar	18,627	187,729	412,735	245,304
Malta and Gozo	44,429	548,256	858,390	741,377
Cyprus	137,864	1,215,375	1,629,746	1,534,370
Sierra Leone	40,821	255,693	322,780	430,867
Gold Coast	85,800	1,786,041	1,695,406	1,798,405
Nigeria	315,511	3,105,033	3,403,045	3,380,849
Union of South Africa	1,456,991	17,982,788	15,568,722	17,947,304
Rhodesia and Nyasaland	461,967	5,742,512	5,886,892	6,034,072
Tanganyika	84,862	1,029,795	670,832	869,154
Kenya	156,654	2,031,935	2,978,793	2,594,241
Uganda	63,595	1,143,595	847,109	969,670
Mauritius	60,248	329,863	280,966	430,327
Aden	37,202	501,396	550,528	516,023
Bahrain, Qatar and Trucial States	73,957	1,007,480	993,840	1,576,829
Kuwait	148,883	1,152,885	1,852,776	3,129,451
India	1,493,639	16,262,302	21,214,674	21,972,518
Pakistan	230,668	3,769,437	3,714,476	2,981,236
Singapore	235,485	3,727,678	3,828,554	4,018,122
Federation of Malaya	174,410	2,857,962	3,330,660	3,193,375
Ceylon	171,715	1,481,395	2,354,729	1,789,598
British North Borneo	16,762	236,995	289,900	281,582
Sarawak	8,490	177,079	187,778	240,456
Hong Kong	251,405	2,198,397	2,768,034	2,990,880
Australia	1,538,742	20,946,800	21,148,465	20,321,324
New Zealand	1,048,670	12,304,857	10,477,848	11,785,374
Fiji	15,996	227,796	258,187	195,706
Canada	956,053	8,307,028	12,830,901	12,842,751
Jamaica	156,435	1,095,082	1,172,077	1,381,600
Barbados	40,191	238,818	270,783	235,515
Trinidad	144,869	1,100,151	1,158,184	1,356,769
British Guiana	35,444	539,293	462,781	503,285
Other Commonwealth countries	77,471	1,353,158	1,117,615	1,388,250
Irish Republic	312,099	4,082,727	3,393,340	2,875,623
Soviet Union	104,119	3,734,501	2,410,368	2,067,448
Finland	145,251	1,590,751	1,933,144	1,662,703
Sweden	406,918	4,151,913	4,367,096	4,891,225
Norway	224,720	3,425,208	2,784,394	2,800,493
Iceland	33,184	161,363	184,514	193,446
Denmark	191,712	1,837,911	2,282,947	2,272,203
Poland	128,673	210,716	317,628	823,116
Western Germany	304,171	2,117,664	2,180,385	2,674,226
Netherlands	655,439	6,801,482	8,268,638	7,844,046
Belgium	263,977	2,963,411	3,477,997	3,619,774
France	192,703	3,064,205	4,191,791	3,913,766
Switzerland	122,998	1,097,890	1,232,563	1,482,805
Portugal	332,563	2,156,853	2,213,811	3,341,791
Spain	133,206	1,695,197	4,693,556	3,664,666
Italy	289,866	2,908,215	3,419,635	3,969,847
Austria	30,709	524,013	463,769	460,641
Yugoslavia	70,924	664,933	632,672	735,468
Greece	127,050	1,282,106	2,431,212	1,418,998
Turkey	160,487	1,162,448	864,178	1,016,179
Belgian Congo	34,403	319,176	347,112	568,177
Portuguese East Africa	20,618	245,931	289,948	327,538
Egypt	34,611	1,717,200	1,721,024	204,124
Libya	38,235	213,149	349,079	467,797
Southern Morocco	24,671	383,569	562,508	430,087
Sudan	80,794	860,665	831,522	1,158,015
Syria	38,978	396,293	763,319	331,870
Labanon	177,453	411,072	654,255	659,129
Israel	89,472	497,802	1,096,682	744,237
Jordan	96,184	429,336	573,882	628,316
Saudi Arabia	69,640	945,121	1,376,495	574,770
Iraq	185,213	2,345,709	3,194,315	2,832,200
Iran	443,215	840,477	2,212,511	4,292,230
Burma	175,456	1,806,559	1,250,707	1,269,445
Thailand	114,087	1,630,533	1,089,550	1,035,595
Indonesia	47,889	422,049	594,855	554,850
Japan	51,061	1,087,715	793,824	819,633
United States of America	534,567	5,320,356	9,200,936	12,608,258
Cuba	105,684	271,853	438,648	821,105
Mexico	53,353	453,369	822,155	678,796
Colombia	88,530	902,442	912,358	760,325
Venezuela	411,972	2,425,804	3,121,551	3,729,345
Peru	42,593	446,010	785,724	651,286
Chile	73,903	310,627	430,483	648,559
Brazil	120,622	793,147	1,757,333	1,336,121
Uruguay	37,031	378,680	133,695	283,451
Argentine Republic	244,024	1,700,458	962,785	1,769,117
Other foreign countries	367,419	2,649,290	3,237,557	4,467,348
TOTAL	17,915,874	191,557,342	216,809,333	227,231,961



Graphs showing the monthly and cumulative values of exports of British electrical equipment for the years 1956 and 1957 and (below) the monthly trend of electrical imports



(£17·9 million) was third, Canada (£12·8 million) fourth, and New Zealand (£11·8 million) fifth. Outside the Commonwealth, the United States was the leading buyer with a total of £12·6 million. It is interesting to note that while exports to most of the Middle East countries declined, those to Iran at £4,292,230 were nearly double the exports for 1956. The exports in December, with the total value for the year compared with 1956, are shown in Table I.

Of the £35·1 million of generating sets, motors, etc., exported during the year, India, with a total of £3,789,636, took first place, but was closely followed by Australia with a total of £3,702,885, and South Africa with £3,267,794. India was easily the best market for converting machinery, mercury-arc rectifiers, transformers, etc., with a total of £6,449,010, the next best being South Africa with £3,692,064; Australia purchased plant valued at £2,911,252, and Canada's total was £2,713,884. In the radio equipment group, the best Commonwealth market was Australia which purchased equipment valued at £2,582,935, while outside the Commonwealth, the

TABLE III.—OTHER ELECTRICAL EXPORTS

Class	December 1957	Year 1956	Year 1957
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	312,591	3,518,575	3,378,729
Over 150 lb	119,689	1,214,060	1,186,245
Parts	91,525	801,583	724,653
Electric locomotives	364,954	2,879,175	3,730,314
Diesel locomotives with electrical transmission	46,600	8,203,953	3,155,391
Weld.ng electrodes:			
Ferrous	97,617	1,065,242	1,070,895
Non-ferrous	24,958	301,223	308,381
Electric conduit tubes and cased tubes	57,918	944,105	822,545
Electric carbons	42,430	604,130	636,776
Electric lighting fittings and lanterns (excluding arc lamps, searchlights and cycle lamps)	163,689	1,827,352	2,423,895
Other electric lighting appliances (excluding vacuum tubes and lamps) and fittings and parts, n.e.s.	200,617	3,799,653	2,649,964

Netherlands bought apparatus valued at £2,353,002. Of the telegraph and telephone apparatus exported during the year (£22·7 million), Australia took equipment to the value of £3,663,748, South Africa £2,624,577 and New Zealand £2,171,545.

Exports of cables and wires at £36·4 million showed an increase of about £1,000,000, mainly due to supplies of submarine cable, the value of which rose from £2,051,258 in 1956 to £4,273,640 last year, and to the demand for thermoplastic-insulated cables, the value of which was £2,371,378 in 1957 (against £1,776,654 in the previous year).

In Table II are set out the destinations of the exports shown in Table I, while the comparative trends (monthly and cumulative values) are shown in the accompanying diagram. Electrical goods included in other sections of the returns are shown in Table III.

Higher Imports

Electrical imports during 1957 totalled £26·8 million, an increase of about £3 million as compared with 1956, radio equipment again being the principal class of imports. The United States continued as the main supplier with a total of £7·7 million, Western Germany being second with nearly £5 million and the Netherlands third with £4·1 million.

TABLE IV.—ELECTRICAL IMPORTS

Class	1956	1957
	£	£
Generators, including parts	915,379	803,246
Motors, including parts	1,034,153	1,149,850
Rotary convertors, mercury-arc rectifiers and transformers rated at not less than 1 kVA on continuous load	425,797	347,094
Switchgear and switchboards (other than telegraph and telephone)	687,090	537,299
Valves, electronic, excluding X-ray valves (whether separately consigned or with the apparatus of which they form a part), complete	1,746,043	1,583,503
Cathode ray tubes, complete	802,156	1,618,533
Parts of electronic valves and cathode ray tubes (excluding glass bulbs)	469,618	385,095
Apparatus for radio, television and radar—		
Radio receiving sets of the domestic or portable type, and radio for motor vehicles	377,568	392,172
Radio communication and navigational aid (including radar) equipment, complete	2,656,626	2,678,976
All other apparatus, parts and accessories	3,638,234	4,120,794
Apparatus for telegraphy and telephony	1,505,376	1,263,892
Welding machinery other than tube making (excluding welding electrodes)	286,455	354,948
Electric cooking and heating apparatus (other than for motor vehicles)	836,837	1,157,819
Magnetos, ignition, and electrical appliances for aeroplanes, motor vehicles and cycles	1,755,735	2,068,303
Electro-medical apparatus (including X-ray apparatus, tubes and valves)	843,694	990,154
Portable mechanical appliances, electrically operated (including parts)	1,228,329	1,805,079
Scientific electrical instruments (excluding telegraphic and telephonic)	1,095,537	1,508,058
All electrical machinery, apparatus and appliances, not elsewhere specified	3,376,721	4,003,709
TOTAL	23,681,348	26,768,524

INDUSTRY AND THE HOUSE

By A. M. F. PALMER, A.M.I.E.E., M.Inst.F., M.P.

RECENTLY a new complaint has taken possession of the newspapers. "Parliament," they say sadly, "is not what it was." Debates, according to these acid spectators of affairs, are dull and empty. Members, if not plain stupid, are too clever by half and lack principles. Party rules all; the individual counts for nothing. Being much in the institution myself, I will refrain from retort to the critics—at least for the moment. But if the House of Commons has its routine days—and who would deny that it has?—it has also its occasional hours of greatness. The Thorneycroft resignation debate provided such an interval.

When a Minister of the Crown leaves an administration over a difference of principle with his political friends it is a custom that he should have an early opportunity of making an explanation to the House. The event is always exciting and interesting; it is particularly exciting and interesting when the resigning Minister has held the great public office of Chancellor of the Exchequer. Hence, in accordance with historical precedent, the chamber was packed to bursting point last Thursday. Every green bench was crammed and wedged full with honourable members; some occupied less elevated places on the floors of the gangways; others found standing room at the bar of the House and around Mr. Speaker's chair.

The new Chancellor, Mr. Heathcoat Amory, opened the debate by moving a short motion designed carefully to help to the maximum the desired unity of the Conservative ranks. Now, Mr. Amory is no sparkling orator in the ordinary run of things. He speaks quietly and at times haltingly; he makes no parade of intellect (although he has obviously a good brain); he is not given to emotional phrases (although he seems to reflect feeling by his shy manner). He has obviously succeeded so far in the House of Commons and has climbed high. What is the secret? I think in his case it is that elusive quality called "character." He seems to be a man transparently anxious to do his duty with as little fuss as possible. Certainly he is liked everywhere. Whether, however, he is the tough material that the Treasury needs just now is an unsettled question. It was, I believe, Oscar Wilde who was sorry for the man who has no enemies.

In his short speech, which was listened to on the whole respectfully, the Chancellor declared that as far as the Government was concerned inflation was still the danger. The firm measures adopted last September would be continued "without relaxation." Government expenditure would be limited severely. The aim was "stable prices at home and a stronger pound abroad." On all financial issues the test to be applied was: would the proposed action hinder or forward the attainment of our dominant aim? After Mr. Roy Jenkins, the Labour Member for Stechford who specialises in economic questions, had intervened to ask how expanded production fitted into the picture, Mr. Amory acknowledged that the long-term future of the country lay "in the fullest use of all resources, human and material." But he insisted on repeating his point that the strength of sterling took precedence over everything else.

From this I can only conclude that the Government and the Treasury are bent on pursuing a deflationary policy come what may and, hence, the Cabinet's dispute with Mr. Thorneycroft was one of tactics and not of strategy. The trouble is to fit in the remark of Mr. Nigel

Birch who resigned from the Treasury at the same time as his chief. The former Economic Secretary, it will be remembered, stated that he and his friends were out " to fight the battle of inflation " but the rest of the Government were not.

Mr. Gaitskell, when he spoke, attempted to solve the riddle of motives by suggesting that Mr. Thorneycroft had now accepted the full logic of Conservative policy over the last two or three years, but others (meaning Mr. Butler), with their Welfare State sentiments still clinging to them, hoped to " muddle through." The immediate issue for the country and industry is where stands the new Chancellor of the Exchequer? I think he has been compelled, perhaps reluctantly, to wear his predecessor's discarded mantle. We shall all know more as future events unfold.

If Mr. Amory's appeal is hard to fasten down, Mr. Gaitskell's is not; it is intellect, pure and simple. To those who enjoy crystal clear explanation and rational exposition of argument the Leader of the Opposition must be almost unequalled as a speaker. In the debate he was, I thought, well on form. Exactly and fairly he contrasted one Conservative argument with another, pointed out the contradictions and examined the implications. Then he set out his own view of the country's economic and commercial position in lucid language. Maybe the professional economist was a bit too much to the front here and took precedence over the politician, but it all sounded reasonable enough and not a bit dull.

Then he came finally to the alternative Government's remedy which, since it is based on quite different assumptions from that of the present Government, should be set out shortly as expounded by Mr. Gaitskell.

The Opposition believed that the object of monetary policy should be expansion and full employment. If production was not expanding then that was a reason for not tightening but letting up so far as production was concerned. The Labour Party could not accept that the balance of payments should come before the maintenance of full employment. After all, that was the pre-war position; the accounts were then balanced by having two million workers unemployed. To-day a Labour Government would not shrink from the use of import and investment controls to keep matters right. With rising and not falling productivity it should be possible to grant wage increases on a basis of an understanding with the trade unions. Sooner or later we should have to choose between voluntary restraint with expanding production or compulsory restraint with stagnant production, and of these two the Opposition wanted the former said Mr. Gaitskell.

However, as I suggested at the beginning, this was really Mr. Thorneycroft's day and he made the fullest use of it. All his old showy slickness suppressed, he spoke firmly, sincerely and briefly about his reasons for resigning his office. True, he possibly over-simplified complex matters but the broad effect was good. He remarked that no Chancellor has won as yet in the post-war battle that he had been engaged in. Sir Stafford Cripps had tried, as had Mr. Gaitskell, and the other Conservative Chancellors, but none had been wholly successful. He wished the new incumbent better luck than he had had but at all costs the country must be told the truth.

There were several good speeches made afterwards in the general debate but for once nearly everything was said in the three speeches I have just described.

Testing 132 kV Condenser Bushings

INVESTIGATIONS undertaken by the former C.E.A. Research Laboratories into the state of old condenser bushings, with main insulation of synthetic-resin bonded paper, which have been in service on the 132 kV grid for upwards of 20 years, were described by Messrs. J. L. Douglas and A. W. Stannett in a paper presented on 29th January before the Institution of Electrical Engineers' Supply Section.

Destructive examination of bushings with characteristics typical of clearly-defined groups, which were carried out in the laboratory, had enabled particular power-factor/voltage and capacitance characteristics to be associated with definite defects, provided either that the original characteristics were known or that the samples tested were large enough for these properties to be inferred. Field tests showed that the properties of the other bushing components, such as porcelain weather-shed, arc shield, oil and breaker parts prevented diagnosis of minor defects, which was possible by laboratory tests on the condensers alone. A technique was, however, devised for non-destructive testing of installed bushings and applied to over 1,600 oil circuit-breaker bushings with the result that 4 per cent were removed and another 3 per cent were classified as being in doubtful condition. A portable Schering bridge was constructed for 30 kV, which was regarded as the maximum voltage for reasonable portability.

Insulation was found to deteriorate in the following ways: ingress of water; erosion at foil edges resulting in puncture of sections; deterioration of connections to buried foils; formation of voids or cracks; penetration of oil. These conditions could be diagnosed in the laboratory by power-factor/voltage tests. Water penetration or erosion was considered sufficient to warrant removing a unit from service; the other three defects would not lead directly to breakdown. With site measurements, the shape of the power-factor/voltage curve was much more important than the absolute values of power factor, and as the greatest change of power factor with voltage occurred at the lower test voltages a maximum of 30 kV was adequate; p.f. tests at working voltage were of little value. Annual insulation-resistance measurements and inspection of bushing oil levels would detect the conditions that led to surface cracking, while annual site measurements of capacitance would detect punctured sections.

British Electrical Conference in Brussels

THE accommodation position in hotels in Brussels for the period of the British Electrical Conference to be held at the Brussels Exhibition on 16th-17th May is very difficult indeed, and any intending delegates who require the organisers to secure accommodation for them must notify their requirements to the Organising Secretary, 1958 British Electrical Conference, 36, Kingsway, London, W.C.2, not later than 11th February. After this date it will be necessary for delegates to make their own arrangements for accommodation, although it is possible that travel agencies may be able to help.

VIEWS on the NEWS

By REFLECTOR

SIR JOHN COCKCROFT was closely questioned by three journalists in the television programme "Press Conference" last Friday and, I thought, handled his interviewers in a masterly, though quite unassuming, way. The principal matters raised were the attitude of the Americans towards the achievement of ZETA, the prospect of electricity generation from nuclear fusion, and the remuneration of British scientists. In spite of some leading questions by Mr. Joseph Harsch, London representative of the American Columbia Broadcasting System, Sir John avoided any suggestion that the Americans were in any way jealous or depreciative of the work at Harwell. He declined to be at all specific about the date at which a nuclear-fusion power station might be in operation, but seemed to acquiesce in the suggestion that twenty years might be a possible period. As regards the question of scientists' salaries, he agreed that the Russians treated their top men better than we did ours, but as he is a member of the Atomic Energy Authority which has just received a claim for substantial increases in salaries from its employees he naturally had to be non-committal.

* * *

In its annual report the National Parks Commission makes reference to the proposed overhead line between Drakelow power station, Burton-on-Trent, to Fleet, Hampshire. The report says:—

> "The Central Electricity Authority have now announced . . . that for the time being they are suspending the proposed 275 kV supergrid line between Fleet and Drakelow."

That, of course, is what they (or their successors) are *not* doing.

* * *

In a recent note I recorded alleged difficulties in the pronunciation of Trawsfynydd, where one of the nuclear power stations is to be erected. In a letter which he has sent me Dr. H. J. Denham, C.B.E. (Little Hadham, Herts), says that he thinks it still possible to improve on the original Welsh. "The Army, with its happy gift of creating unforgettable names (remember Wipers), always referred to its training range there as 'Trousers.'" I should perhaps remind my readers that the Welsh pronunciation was given as "Trowsvunith."

* * *

The *Electrical Power Engineer* for January comments on what must be a unique case in salary negotiation. It says that at a meeting of the National Joint Board for the Electricity Supply Industry a letter was presented from a firm of solicitors submitting a claim for classification adjustment on behalf of a technical engineer who was not a member of the Electrical Power Engineers' Association or other trade union. While there can be no compulsion upon such a man to join a union it is the fact that negotiating bodies in the industry are representative of the electricity authorities and the trade unions concerned. In the case of a trade unionist any claim would be passed through his union who would deal with it in the light of general considerations. Otherwise the applicant must approach his employer himself. It seems to me that if joint councils were expected to deal with individual applications there would soon be chaos.

* * *

In an article, "Electricity Comes to the Village," in the *Sketch*, Mr. Tudor Edwards writes of the prejudice which has to be met by the Electricity Boards when they extend their supplies to the countryside. He says:—

> "There is joy in storing oil and in pouring it into the well of the lamp and watching the bright flame dancing around the wick and growing higher and higher at one's will."

Evidently, however, this doubtful joy is not experienced by all villagers for, says Mr. Edwards, "the more progressive section of the community . . . has long agitated for electric light"—and for something more than light the Board hopes, no doubt.

* * *

Most electricity consumers, I suppose, are unlikely to question accounts which seem to undercharge them, but the Deben (Suffolk) Rural Council has been shocked into honesty by a bill from the Eastern Electricity Board for electricity used in water-pumping. It points out that although it pumped 1½ million gallons more than in the previous month its electricity bill went up by only 7d. This certainly seems too good to be correct. It reminds me of the hope often expressed that one day electricity will be on tap like water—and as cheap.

* * *

This week I go back eighty years for my echo of the past. In the *Electrical Review* of 1st February, 1878, there appeared the following report redolent of its period:

> "On the evening of Monday, January 14th, Professor Graham Bell had the honour of exhibiting to the Queen the marvellous capabilities of the telephone. The trial took place in the Council Chamber of Osborne House, Isle of Wight, in the presence of Her Majesty, the Princess Beatrice, the Duke of Connaught and others of the Court. A temporary line three-quarters of a mile long had been erected between Osborne House and Osborne Cottage, the residence of Sir Thomas Biddulph, and the experiments began by the Princess Beatrice speaking with Lady Biddulph. At Osborne Cottage Miss Kate Field, the well-known vocalist, sang 'Kathleen Mavourneen,' 'Coming Through the Rye' and the 'Cuckoo Song,' then recited the epilogue of *As You Like It*, all of which were heard by the Royal party, and so well appreciated that the Queen thanked the singer personally through the telephone."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Sir John Cockcroft, K.C.B., F.R.S., is relinquishing the position of director of the Atomic Energy Establishment, Harwell, but will remain on the United Kingdom Atomic Energy Authority as member for scientific research, free from executive responsibility. His successor as director at Harwell is **Dr. B. F. J. Schonland,** C.B.E., F.R.S.

Sir John Cockcroft

Dr. B. F. J. Schonland

Mr. W. R. J. Cook, deputy director of the Atomic Weapons Research Establishment, Aldermaston, is to be a full-time member of the Authority. **Sir William Penney** will continue to be member for weapons research and development and, pending the appointment of a new director at Aldermaston, he will continue to hold that post, too.

Mr. K. D. Stegler, D.L.C.(Eng.), A.M.I.E.E., with his wife and children, arrived in Australia from the P. & O. *Iberia* in mid-January to take up residence in Melbourne, where he will act as liaison officer between the works of the Electric Construction Co., Ltd., and colleagues out there, providing technical and engineering service for the sales of the company's equipment in Australasia.

Mr. K. D. Stegler

At the recent annual dinner for the Graduate and Technical Apprentices Association given by **Lancashire Dynamo & Crypto, Ltd.,** at Trafford Park Works, Manchester, Mr. A. W. A. Dick-Cleland (joint managing director) introduced the guest speaker, Dr. C. Whitworth, principal of the Royal Technical College, Salford. Mrs. Dick-Cleland presented trophies and awards to the following apprentices:— The "D-C" cup for best all-round apprentice of the year to Mr. R. Tonge, who was winner of the "Abbey" trophy in the previous year; second prize, Mr. I. A. Woods; third prize, Mr. C. Thomas; fourth prize, Messrs. R. G. Wilson and M. Dover. The "Abbey" trophy for the apprentice with the highest percentage of marks in the ordinary national certificate examination was won by Mr. R. D. Ainscow. A replica of the "D-C" cup was presented to last year's winner, Mr. A. Clegg.

Mr. Max Millar, one of the senior executives of the Benjamin Electric, Ltd., leaves London by air on 12th February for a business tour of the Middle East, where he will make contact with many oil companies, electrical contractors, building contractors and others, to study local conditions and requirements and discuss technical trends and developments in lighting, as applicable to those countries. Mr. Millar expects to be away for seven to eight weeks.

Long service awards were made to seventy-seven members of the office and works staff of **G. A. Harvey & Co. (London), Ltd.,** on 24th January when Mrs. Sydney Harvey, wife of the president of the company, presented watches, suitably engraved, to each member. The proceedings were opened by Mr. G. Harvey, joint deputy chairman, who read a telegram from the chairman, Sir Thomas Overy, regretting his inability to be present. Thanks on behalf of the recipients was expressed by Mr. P. T. Bliss, director in charge of sales and publicity, who, during the evening, had received a special presentation to mark his fiftieth year with the company.

Mr. A. D. Bailey, A.M.I.Mech.E., A.M.I.E.E., manager of the Newcastle sales office of Brook Motors, Ltd., for the past 4½ years, will be taking over management of the Birmingham office from 1st February. Mr. Bailey was formerly in the Production Planning Department and later senior assistant in the Fractional Horse Power Motor Department at Huddersfield. He takes over from **Mr. T. Herd,** who has been in charge at Birmingham since 1946. Mr. Herd will shortly take up a new appointment with the company. At Newcastle, **Mr. H. Boothroyd,** formerly sales engineer, will become manager. Mr. Boothroyd, who has been with the company for nearly twenty-five years, was educated at Huddersfield Technical College and was technical development engineer with the Industrial Equipment Co. of Ireland, Ltd., Brook agents in Eire, from 1948 to 1949. **Mr. R. Sugden,** sales engineer at Norwich since 1955, now moves to the same position at Newcastle.

Mr. A. D. Bailey

Mr. H. Boothroyd

Mr. R. Sugden

Mr. J. Martin, Associate I.E.E., Dip.M.I.E.S., has been appointed manager of the London Maxlume Division of Veritys, Ltd. He received his technical training at Dudley Technical College and after serving an electrical apprenticeship joined the Benjamin Electric, Ltd., in 1934 as sales engineer (East Midlands). He left in 1946 to join Thorn Electrical Industries, Ltd., with whom he was successively illuminating engineering department manager, and area technical sales manager (North West area). In 1957 he joined Veritys, Ltd., being originally attached to their Manchester branch. Mr. Martin has been chairman of both the Leicester and Manchester Centres of the Illuminating Engineering Society.

Mr. J. Martin

Miss A. Cook, M.B.E., has vacated the secretaryship of Belling & Lee, Ltd., and is now commercial director of the company. She has been succeeded as secretary by **Mr. C. R. B. Townend,** M.A., A.C.A.

The 24th **E.D.A. Carnival** took place on 17th January at the Oxford Galleries, Newcastle-on-Tyne, when Mr. A. J. Crawford, chairman, Tyne and Wear Area, Electrical Industries Benevolent Association, and Mrs. Crawford received upwards of 1,000

guests. During the evening 150 prizes, given by all sections of the electrical industry, were distributed to the guests for various events. The proceeds from the Carnival will be given to the E.I.B.A.

Mr. A. B. Wildsmith relinquishes his appointment as director and secretary of the Electrical Wholesalers' Federation on 6th February on reaching the age of 65. After service during the first world war, Mr. Wildsmith joined Edison & Swan as export representative in the West End of London and later in the City. He then went to a firm of electrical wholesalers where he met Mr. E. D. Young,

Mr. A. B. Wildsmith

Mr. P. B. Etheridge

and with him started operations as Young & Wildsmith in 1925. While with the company he represented it in the E.W.F. and served six years on the Council. In 1939 he decided to leave the commercial sphere and accept the appointment of assistant director to the late Mr. A. Albrecht, and on Mr. Albrecht's death in 1947 he succeeded to the directorship. During his nearly 40 years in the industry Mr. Wildsmith has become very well known and he will be missed at electrical functions. He will continue to live at Hambleden.

Mr. P. B. Etheridge, who has been with the E.W.F. since May, 1956, succeeds Mr. Wildsmith as director and secretary of the Federation. Born in 1919, Mr. Etheridge was educated at Merchant Taylors' School and University College, London. After service in the Army in the 1939-45 war he qualified as a solicitor. Before joining the E.W.F. he served for six years on the staff of the Federation of Civil Engineering Contractors.

Mr. A. Dryburgh, A.A.C.C.A., A.C.W.A., has been appointed accountant of the Glasgow Area of the South of Scotland Electricity Board in succession to **Mr. W. B. Mackay,** who recently took up an appointment at the Board's head office. Mr. Dryburgh is at present the accountant of the Lanarkshire Area of the Board at Hamilton.

Mr. H. E. Reynolds has been appointed manager of the Bristol office of Ruston & Hornsby, Ltd. He succeeds **Mr. C. W. Hudson,** who retired at the end of last year after more than fifty years with the company. Mr. Reynolds joined the company thirty years ago and during the war served as an engineer officer with the R.A.F. Demobilised as a squadron leader in 1946, he returned to Ruston & Hornsby as technical representative at its London office, and from there went to Bristol as assistant manager at the beginning of 1955. He is an associate member of the Institution of Locomotive Engineers.

Mr. H. Hanson, deputy chairman and joint managing director of Turner & Newall, Ltd., has resigned owing to ill-health. He joined the organisation fifty years ago. **Mr. R. G. Soothill,** formerly joint managing director with Mr. Hanson, has been appointed deputy chairman.

The Minister of Power has appointed **Alderman C. Matkin,** B.E.M., of Oakham, **Councillor A. L. Heason,** Associate I.E.E., of West Bridgford, Nottingham, and **Mr. O. T. Green,** of Staverton, Daventry, to be members of the East Midlands Electricity Consultative Council. **Mr. C. E. Fry,** A.M.I.E.E., of Skegness, has recently resigned from the Council.

Mr. A. F. Appleton, formerly head of the electronics and vibration laboratory of Bristol Aircraft, Ltd., Filton, Bristol, has now taken up an appointment as chief engineer with Benson-Lehner (G.B.), Ltd., Southampton.

The Minister of Labour and National Service has appointed **Dame Florence Hancock,** D.B.E., and **Brigadier J. J. Sloan,** O.B.E., M.C., to be directors of Remploy, Ltd., the company established by the Government to provide sheltered employment for severely disabled persons.

The annual dinner and dance of the Cardiff Centre of the **Illuminating Engineering Society** was held on 3rd January at the St. Mellons County Club. The guests included Mr. E. B. Sawyer (president) and Mrs. Sawyer, Mr. G. E. Smith (chief commercial officer, South Wales Electricity Board) and Mrs. Smith, Mr. R. H. Hill (chairman, I.E.S. Bath and Bristol Centre) and Mrs. Hill, Mr. H. A. Partridge (assistant district mangaer, General Electric Co., Ltd.) and Mrs. Partridge, and Mr. D. B. Francis (chairman, I.E.S. Swansea Group). The toast to the Society was proposed by the chairman, Mr. M. E. McCann, and Mr. Sawyer replied.

Mr. L. G. Bettinson, whose article, "Selling Electric Fires in America" (page 209), should give encouragement and guidance to manufacturers wishing to cultivate the United States market, is an executive director and export manager of Berry's Electric, Ltd. Mr. Bettinson was born in London in 1919 and after technical and commercial training at Southend joined the Electricity Department of that town. From 1936 to 1946 he served in the R.A.F., winning the Distinguished Flying Cross, and afterwards took up a position with the Wessex Electricity Co. which, in 1948, was taken over by the Southern Electricity Board. He went to Berry's Electric, Ltd., in 1950 as a representative, becoming export manager in 1954 and executive director at the beginning of this year.

Mr. L. G. Bettinson

Mr. E. C. Avery, superintendent of Littlebrook (Kent) "A," "B" and "C" stations of the South Eastern Division of the C.E.G.B., has retired after fifty-one years of service in the electricity supply industry. A dinner and dance in his honour was given by the station staff on 14th January, when presentations were made to him and Mrs. Avery. Amongst those who attended were Mr. W. H. Dunkley, controller of the South Eastern Division, Mr. W. C. Parker, former controller of the Division and now director

At the I.E.S. Cardiff dinner-dance. Left to right (standing): Mr. D. B. Francis, Mr. H. A. Partridge, Mrs. Partridge, Mrs. Smith, Mr. G. E. Smith, Mrs. Hill and Mr. R. H. Hill; (seated): Mr. M. E. McCann (chairman), Mrs. Sawyer, Mrs. McCann and Mr. E. B. Sawyer

of the North West, Merseyside and North Wales Region, and Mr. P. Briggs, director of the North Eastern and Yorkshire Region.

The new superintendent of these power stations is **Mr. F. R. Wilkinson,** A.M.I.E.E. Mr. Wilkinson began his career as an articled apprentice with Veritys, Ltd., Birmingham, in 1928, and in 1932 joined the City of Birmingham electricity supply undertaking. From there he joined the Leicester electricity undertaking in 1936, and left his position as boiler house shift engineer to become a charge engineer at Brighton "A" power station in 1948. In 1951 Mr. Wilkinson became deputy station superintendent of Kingston "B" power station, and in 1953 he took the same position at Littlebrook.

Mr. J. D. Roberts has been appointed assistant domestic sales manager of Prestcold Refrigeration. He has been with the Pressed Steel Co., Ltd., for many years and before joining the sales side some four years ago was one of the company's area service supervisors.

Mr. J. D. Roberts

In the report of the annual staff dinner of **F. Westerman (Wholesale), Ltd.,** in our issue of 17th January, Mr. N. G. Smith was described as joint sales manager of Edmundsons Electric Co., Ltd. He is, in fact, joint managing director of that company.

Mr. W. Dalziel, production manager of the Electronic and Equipment Group of the Plessey Co., Ltd., and **Mr. H. Fox Wright,** contracts manager of the company, have been appointed executive directors.

Mr. Dalziel joined Plessey at Ilford in 1938. For the past few years he has held the post of production manager of the Electronic and Equipment Group, where he is responsible for the production and administration of five separate divisions within the Group.

Mr. Wright, who joined Plessey in 1937, was educated at Epsom College, Surrey, and at the De Havilland Technical School, Edgware. After serving with the Breeze Corporation, Ltd., and De Havillands he was appointed to the central sales staff of Plessey, and in 1946 became contracts manager of the company, a position which he still holds.

Mr. W. Dalziel

Mr. H. F. Wright

The Wandsworth Electrical Manufacturing Co., Ltd., has appointed **Mr. J. B. Aitkenhead** as technical sales representative for North West England, covering Lancashire, Cheshire, North Wales, Cumberland and Westmorland.

Mr. J. Sharp, B.Sc., A.M.I.E.E., chief engineer of the valve division, E.M.I. Electronics, Ltd., attended the sixth Scintillation Counter Symposium held on 27th and 28th January in Washington, D.C., U.S.A., and sponsored jointly by the American Institute of Electrical Engineers, Institute of Radio Engineers, Atomic Energy Commission and National Bureau of Standards. Mr. Sharp read a paper on "Developments in Photomultipliers by E.M.I."

The Lancashire Dynamo Group announces that **Mr. A. J. Beanland,** B.Sc.Tech., M.I.E.E., A.M.I.Prod.E., Fellow A.M.E.M.E., has been appointed group sales director. Mr. Beanland, who will be a director of Lancashire Dynamo Group Sales, Ltd., will be in charge of the L.D. Group sales organisation at home and overseas. Born in India in 1910, Mr. Beanland graduated in electrical engineering at Manchester College of Technology. He received technical training with Mather & Platt, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., and the Lancaster Corporation Electricity Department and took a post-graduate course with Lancashire Dynamo & Crypto, Ltd. After various engineering appointments with Lancashire Dynamo & Crypto he became its branch manager at Leeds in 1945, manager of the Cardiff fractional h.p. motor factory in 1949 and subsequently director and general manager at the Trafford Park Works. He takes up his new appointment on 1st March. Mr. Beanland recently visited Russia as a member of a delegation from the consortium, known as Rustyfa, which has secured a large order for the supply of equipment for a tyre factory to be built in the Ukraine.

Mr. A. J. Beanland

Mr. R. W. Dowsett, Associate I.E.E., an executive director of M.K. Electric, Ltd., and until recently general works manager, has now been appointed deputy general manager. **Mr. D. W. Roberts,** A.M.I.P.E., for many years production manager, is now works manager. Mr. Dowsett and Mr. Roberts joined M.K. Electric thirty-four and twenty-five years ago, respectively.

Mr. R. W. Dowsett

Mr. D. W. Roberts

Mr. N. Devonald, B.Eng.(Hons.), A.M.I.E.E., of switchgear contracts, British Thomson-Houston Co., Ltd., Willesden, retired on 27th January after forty-five years' service with the company. Mr. Devonald was educated at Widnes Secondary School (now the Wade Deacon Grammar School) and Liverpool University, and commenced an apprenticeship at the B.T.H. Rugby Works in 1913. After service in the 1914-18 war, in which he attained the rank of captain, he rejoined the B.T.H. Company at Rugby in the Contracts Department. He was transferred to Willesden (Switchgear Sales) in 1926, and handled business associated with the London district.

OBITUARY

Mr. J. P. A. Meldrum.—The death occurred on 20th January, as the result of a motor accident, of Mr. John Patrick Arthur Meldrum, O.B.E., B.Sc., M.I.E.E., director and manager, home sales, of the Metropolitan-Vickers Electrical Co., Ltd. His wife was also killed.

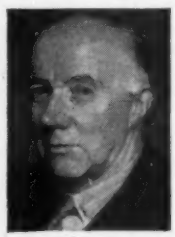
The late Mr. J. P. A. Meldrum

Mr. Meldrum was educated at Rugby and Glasgow University. After a vacation apprenticeship with the Metropolitan-Vickers Electrical Co. in 1924, he joined the company as a college apprentice in 1926, later becoming a special switchgear trainee. In 1930 he was appointed to the staff of the Switchgear Engineering Department. During the last war Mr. Meldrum served in the Royal Corps of Signals. He returned to Trafford Park in 1945 and in 1946 became sales manager, Switchgear Department, being appointed manager, home sales, in January, 1953. He was appointed to the board of the Metropolitan-Vickers Electrical Co. in 1955.

Sir Alexander Gibb, G.B.E., C.B., F.R.S., the well-known civil and consulting engineer, died on 21st January

at the age of eighty-five. Before commencing in private practice in 1921, Sir Alexander was engaged in naval dockyard construction work with Easton Gibb & Son, and during the 1914-18 war he was successively chief engineer for port construction to the British Armies in France and Belgium, and deputy director of docks. In 1918 he became civil engineer-in-chief to the Admiralty and in 1919 director-general of civil engineering to the Ministry of Transport. In private practice he was associated with the Severn Barrage Scheme and in 1955 his firm, Sir Alexander Gibb & Partners, signed a contract with the Egyptian Government in connection with the construction of the High Dam at Aswan. Sir Alexander was a past-president of the Institution of Civil Engineers.

Mr. G. Leslie Wates, J.P., Companion I.E.E., died at his home on 22nd January, after a long illness. Until recently Mr. Wates was chairman and joint managing director of Johnson & Phillips, Ltd. A solicitor by profession, he was admitted to the Rolls after a distinguished academic career. He was a partner in the firm of J. D. Langton & Passmore but his activities were not confined to law and he was very prominent in industrial life. Mr. Wates became associated with Johnson & Phillips, Ltd., in 1907 and was appointed to the board of directors in 1927, becoming chairman in 1931. On his resignation as chairman, due to failing health, he was appointed honorary president of the board.



The late Mr. G. L. Wates

Mr. Wates was also chairman of the board of the Canning Town Glass Works, Ltd., and a director of the Woolwich Equitable Building Society, of which he was chairman from 1949 to 1957. He was chairman of the Cable Makers' Association for 1946-47, and chairman of the Council of B.E.A.M.A. for 1950-51, when he initiated a scheme for endowing a Chair of Electrical Engineering at Cambridge University. He was a member of the I.E.E. Council from 1955 to 1957. His interests in education and welfare were exemplified by his chairmanship of the board of the Woolwich Polytechnic, his membership of the Executive Committee of Roffey Park Rehabilitation Centre and his governorships of the Woolwich War Memorial Hospital and the Woolwich Cottage Hospital.

Mr. Ernest Dinsdale Phillips died on 23rd January at his home in Bromley, Kent, at the age of eighty-one. Mr. Phillips was editor and manager of the *Mining Electrical and Mechanical Engineer* from its foundation in 1920 until 1947. He studied science, chemistry, geology and engineering. After an apprenticeship in an engineering works he was employed first as a power station charge engineer. He was then for three years a lecturer at the City and Guilds Central College, London. Thereafter he held successively technical appointments with a number of electrical companies. In 1912 he established his own consulting business in Manchester and specialised in power engineering. Mr. Phillips's connection with the Association of Mining Electrical and Mechanical Engineers began in 1917 and when the Association launched, in 1920, its own journal, the *Mining Electrical Engineer* (the title of which was changed to the *Mining Electrical and Mechanical Engineer* in 1942), he was appointed editor and manager. On his semi-retirement in 1947 he continued as consulting editor till the end of 1951.

Mr. A. E. Cracknell, service manager of Belling & Co., Ltd., died on 24th January in his fifty-fifth year. He had been in the service of the company for forty-one years.

Mr. George Nobbs.—The death occurred suddenly on 26th January of Mr. Cornelius George Nobbs, M.I.E.E., M.I.H.V.E., founder of George Nobbs, Ltd., the well-known electric water heater manufacturers. Mr. Nobbs retired from the company in 1935.

Mr. Herbert William Umney, late Professor of Engineering at the McGill University, Montreal, died on 20th January in his eighty-eighth year at Upper Norwood.

Mr. Charles Pitcher, London manager of Premier Electric Heaters, Ltd., until his retirement in 1950, died on 12th January. Mr. Pitcher joined the company from the British Prometheus Co. in 1912 (one of the pioneers of the electric heating industry), and after service in the original Birmingham works he went out to develop the sales of Premier appliances throughout England, later settling down at Teddington and concentrating on the London area. He leaves a widow.

Mr. C. P. Lamb, East Midlands area manager of Sangamo Weston, Ltd., died on 20th January. Mr. Lamb, who was born in 1904, was apprenticed to the English Electric Co., Ltd., Preston, and was subsequently employed by that company at Stafford, leaving there in 1936 to join Sangamo Weston, Ltd. He served in the Royal Engineers during the last war, attaining the rank of captain. He rejoined Sangamo Weston in 1945 and in December of that year was posted to Wolverhampton as assistant sales engineer, Midlands area. In January, 1950, he went to Nottingham as East Midlands area manager. He leaves a widow and two sons.

New Irish Cable Company

A JOINT venture is announced this week between the Warren Wire Company of New Jersey, U.S.A., and its associates, with Wandleside Cable Works, Ltd., Wandsworth, London, and its subsidiary company, Irish Cables, Ltd., of Newcastle, Co. Down, Northern Ireland. The name of the new company will be Wandleside Warren Wire, Ltd., and it will operate initially from a Government factory near Dunmurry. The initial capital of the company will be £500,000; 51 per cent will be held by the Warren Wire Company and 49 per cent by Falk, Stadelmann & Co., Ltd. The factory will have a production space of approximately 70,000 sq ft and a pilot plant is expected to be installed by March or April next. An annual output is planned, after five years, of 15,000 tons.

Mr. W. L. Wray, managing director of Wandleside Cable Works, Ltd., and Irish Cables, Ltd., who effected the deal during his recent visit to the United States, was also able to arrange the marketing in that country of some of the specialities of the British companies. A joint exchange was made of technical developments, including irradiated cables.

The initial board of the new company is expected to be: Mr. J. R. Cook, of the U.S.A. (chairman), Mr. Hugo Falk, of Falk, Stadelmann & Co., Ltd. (vice-chairman), Mr. W. L. Wray (managing director) and Messrs. W. H. Rice (U.S.A.), W. Thurner and E. E. Maltby (directors). Alternate directors are Messrs. G. W. Edge and R. Knight.

It is anticipated that this new development will considerably increase the group's competitive position in the home and export markets and will result in further expansion in due course at Wandleside Cable Works, Ltd., Wandsworth, and Irish Cables, Ltd., Co. Down.

British Atomic Research at Brussels Exhibition

British thermonuclear research will be the subject of the final section of a Board of Trade exhibit on the theme of "Britain's Plan for Industrial Atomic Power" in the United Kingdom Industrial Pavilion at the Brussels Universal and International Exhibition. It is being organised in close co-operation with the United Kingdom Atomic Energy Authority, who will provide an expert staff to answer inquiries. The exhibit will include a coloured transparency of the ZETA equipment at Harwell and text indicating the prospects for harnessing power from fusion.

The opening sections will display models of Calder Hall and of the first four stations in this country's nuclear power programme. There will also be other official British atomic exhibits.

PARLIAMENTARY REPORT

CRITICISMS of the way in which news about the successful experiments conducted with the ZETA reactor at Harwell was released for publication were made in a series of questions put to Mr. R. A. Butler, Home Secretary and acting Prime Minister, when the House of Commons resumed after the Christmas recess.

Mr. Mason asked, "Why should we receive news of this great experiment from garbled driblets in the Press and finally through the scientific magazine *Nature*? Is not the experiment of such significance that the Government should be prepared to make a statement—and a proud statement—now?"

Mr. Butler did not agree, saying he thought it much better that this highly scientific information should be published, as previously, in a scientific journal; they might then be quite satisfied as to its accuracy.

Mr. Mason gave notice that because the reply was unsatisfactory he would initiate a special debate on the subject.

Mr. Biggs-Davison asked what agreements had been made with the United States Government or Atomic Energy Commission to restrict or delay the publication in the United Kingdom of information about ZETA or other British achievements in the development of nuclear energy for peaceful purposes.

Mr. Butler replied, "None, save those relating to information not divulged on security grounds."

Replying to Mr. Leslie Hale, Mr. Butler said that there would be no modifications in the present plans for the civil nuclear power programme.

Technical Education in Scotland

Mr. Niall Macpherson informed Mr. Bence that of the £10 million programme authorised for buildings for technical education in Scotland, the Government had already approved projects to the value of £7·3 million. Further projects to the value of £1·2 million were being considered and the Government hoped soon to receive others covering the remaining £1·5 million.

Lighting of Traffic Routes

Replying to a debate in the House of Lords on the lighting of trunk and through traffic routes, Lord Bathurst, Lord in Waiting, said the Association of Public Lighting Engineers had produced a useful survey giving detailed information about installations and lighting provided by local authorities. Unfortunately it did not cover more than one-third of the lighting authorities, and the Government had decided to find out the true position. The highway authorities would be asked to make a survey of the classified roads in their areas and to report the extent to which improved or new street lighting was needed. The Minister expected to give a report on this subject within four to six months of the start of the survey. The Minister's own divisional road engineers would make a similar survey of trunk roads.

There was much to be said for the suggestion made by Mr. Granville Berry (city engineer and surveyor of Coventry) that there should be a joint body to look after the lighting arrangements when trunk roads cut through adjoining city outskirts. The Government stated in December that lighting authorities in London would be invited to a conference with a view to setting up a consultative committee. Invitations had now been sent out for that conference, which he hoped would be the start of a policy of co-ordinated lighting systems.

On standardisation, Lord Bathurst said that in the interests of economy, technical progress and competition in local design, the Minister did not at this stage contemplate restricting lighting to one particular type of lamp.

Lord Bathurst said he would like every motorway lighted from start to finish but at present the cost was quite impossible. In the parts that were lit, Group "A" lighting would be the only kind considered.

North of Scotland Board's Accounts

The Government has asked the North of Scotland Hydro-Electric Board to limit its capital expenditure to £18 million in 1958, and £15·5 million in 1959. This will mean a reduction of some £6·5 million compared with 1956.

Mr. John Maclay, Secretary of State for Scotland, gave details of the proposed cuts when the House of Commons debated the Board's report and accounts last Monday. He added that the reduced expenditure would still allow the Board to continue constructional schemes now in progress, and should permit a start to be made on other major schemes, if approved, as well as permitting distribution work at about the same rate as in 1957.

The House heard that the Board's 1957 operations had "broken even," and that it hoped in the coming year to make a significant inroad on its debit balance.

The Board was confident that estimates of current schemes would be much closer to the final cost than in earlier days. It would continue its efforts to obtain fixed price contracts and to invite competitive tenders for all contracts.

The case of Lord Lovat's £100,000 compensation in connection with the Strathfarrar scheme (see page 237) was referred to by Mr. Malcolm Macmillan, for the Opposition. He declared that it was essential that the Board should publish full figures and statistics of all compensation paid.

Nuclear Power Station Contracts

Mr. Palmer asked the Paymaster General by what principle particular firms or groupings of firms had been selected to collaborate with the Atomic Energy Authority and the Central Electricity Generating Board in nuclear energy development, and what arrangements were made for new firms to enter this field.

Mr. Maudling replied that, for technical reasons, the design and construction of a nuclear power station could best be undertaken at present by a group of companies operating under a single contract. Such groups needed to have extensive scientific and engineering resources.

Mr. Palmer: "Is the Minister aware that there is a widespread feeling that the whole of this business is too much a closed circle and that if the fruits of public activity are to be made available to private industry they should be made available to all?"

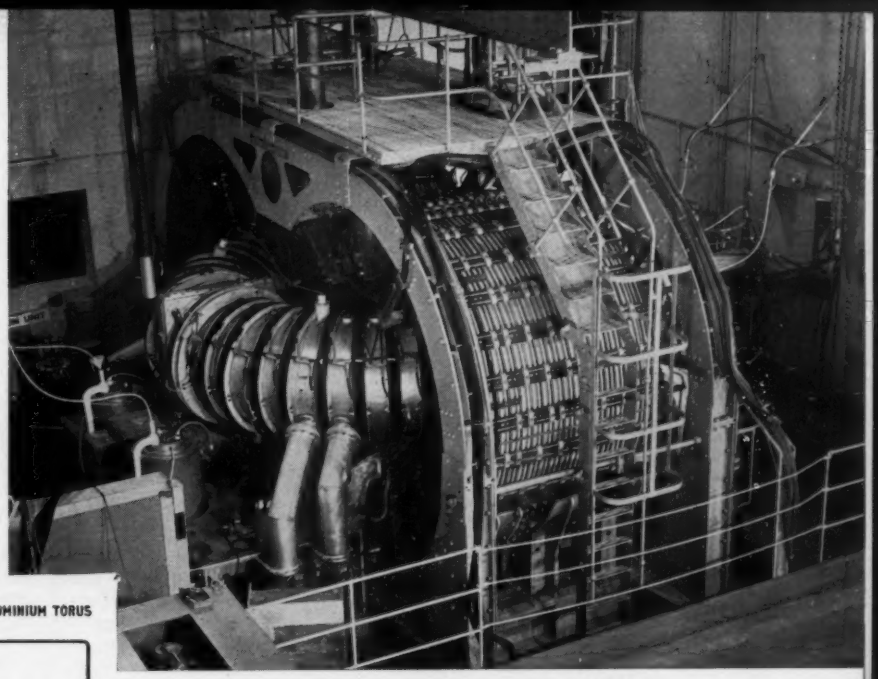
Mr. Maudling replied that when the Authority made available valuable information to the consortia there were terms in the contract providing for appropriate payment and no exclusive rights were granted. He agreed that for the long run this system was by no means perfect. It would be kept under review and there was a possibility at a later stage of returning to conventional methods.

PRICES OF MATERIALS

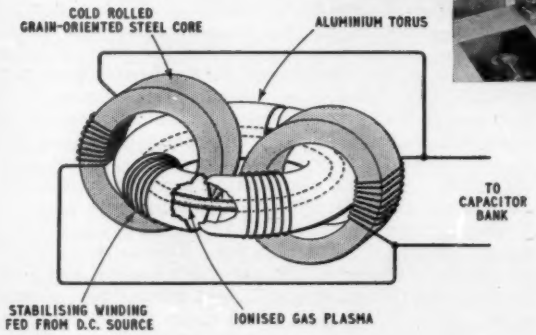
In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £166 15s 0d
Fire Refined 99·70%	ton £165 0s 0d
Fire Refined 99·50%	ton £164 0s 0d
COPPER Tubes ..	lb 1s 7d
Sheet	ton £188 0s 0d
H.C. wire and strip ..	ton £210 15s 0d
LEAD, English ..	ton £71 15s 0d
Foreign	ton £70 0s 0d
MERCURY	flask £73 0s 0d
TIN, block (English) ..	ton £731 0s 0d
ZINC, G.O.B. Foreign	ton £63 10s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 4d
Sheet	ton —
Wire	lb 2s 1½d
PHOSPHOR BRONZE Wire	lb 3s 4½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 22⅛d—22⅜d

DEUTERIUM FUSION INVESTIGATED IN ZETA AT HARWELL



General view of ZETA and diagram illustrating the basic principles of operation



THERMONUCLEAR REACTIONS

ON Friday last the United Kingdom Atomic Energy Authority and the United States Atomic Energy Commission simultaneously made announcements regarding the investigations which they are making into the possibilities of establishing controlled thermonuclear reactions. Encouraging results have been obtained in both countries, so much so that the use of controlled thermonuclear reactions for the generation of electricity is now a distinct possibility for the future. It must be emphasised, however, that although striking advances have been made the practical application of this experimental work is still a long way off.

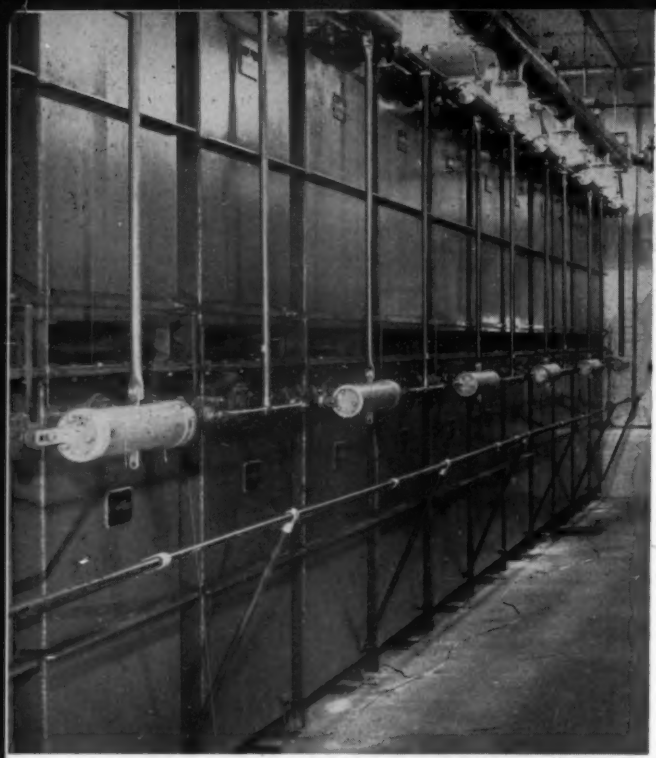
The reports issued last week deal with a challenging field of research in which work has been under way in both the United Kingdom and the United States for some time. Research workers in the two countries pursued independent lines of research until 1956, but since then the two programmes have been the subject of close co-operation including exchange of results and information as a means of more rapidly reaching the common goal. Papers prepared by leading workers in both countries and describing the results achieved so far were published in *Nature* of 25th January.

To put the present work into perspective it should be understood that the operation of existing atomic power reactors is based on the fission (or splitting) of atoms using heavy elements such as uranium or plutonium. The possibility which is now being explored is the harnessing of power from the fusion (or joining) of atoms of light elements such as hydrogen. It is this fusion reaction which provides the heat of the sun and the stars. The results obtained with the experimental rig at Harwell known as ZETA (zero energy thermonuclear assembly) suggest that thermonuclear neutrons have been obtained, but further work will be necessary before this can be proved conclusively. However, the temperatures which have been achieved in this apparatus have been as high as 5×10^6 deg C, higher than the measured surface temperature of any star.

Many major problems have still to be solved before a practical power producing version of ZETA can be seriously considered, and the work must be expected to remain in the research stage for many years. As Mr. Lewis L. Strauss, chairman of the U.S. Atomic Energy Commission, said last week, in the field of fusion we are unfortunately not yet at a point comparable to 2nd December, 1942, when the first self-sustaining fission reaction was obtained. If it does ultimately prove possible to construct a power station operating on the fusion of deuterium (heavy hydrogen, which is written either as H^2 or D), the oceans of the world will provide virtually inexhaustible sources of fuel. The methods of extracting deuterium from water are comparatively simple and well established and it is likely that a thermonuclear power station would be sited near the sea or some other suitable expanse of water and contain its own deuterium production plant.

Experimental Apparatus

On 12th August last year, ZETA, a large experimental apparatus for studying the controlled release of energy from thermonuclear reactions was started up at Harwell. On 30th August this apparatus was first operated under conditions that produced nuclear reactions. Neutrons emitted in these reactions were observed when deuterium gas was heated electrically to temperatures in the region



Part of the 1,600 μF 25 kV capacitor bank which is capable of storing up to 500,000 joules

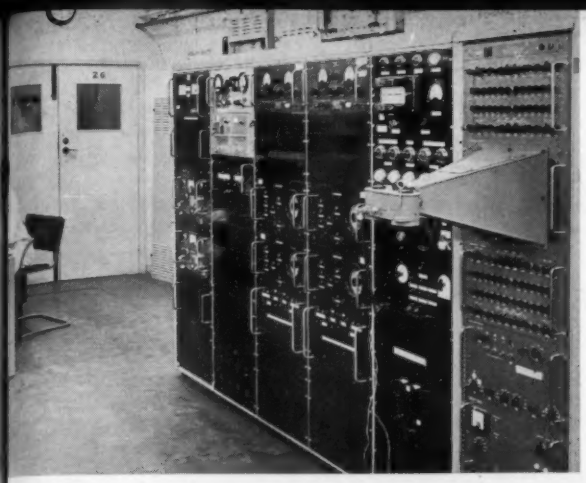
of 2 to 5×10^6 deg C. The hot gas was isolated from the walls for periods of 2 to 5 millisec. The heating process was repeated every 10 sec. The high temperatures achieved, and the relatively long duration for which the hot gas has been isolated from the tube walls are the most important experimental results obtained so far. Although much longer times (perhaps several seconds) are required for a useful power output there appears to be no fundamental reason why these longer times, together with much higher temperatures, should not be achieved.

The source of the observed neutrons has not yet been definitely established. There are good reasons to think that they come from thermonuclear reactions, but they could also come from other reactions such as a collision of deuterons with the walls of the vessel, or from bombardment of stationary ions by deuterons accelerated by internal electric fields produced in some forms of unstable discharge. In the ZETA apparatus the number of neutrons produced by each pulse of energy as the current was doubled was roughly that which might be expected from a thermonuclear reaction at the measured temperatures. These temperatures have been definitely established.

To fill in the background to the present work it should be recalled that the U.K.A.E.A. have stated in their last two annual reports that research has been in progress for some years to investigate the possibility of reproducing energy in a controlled manner from thermonuclear reactions. Over two years ago the design of ZETA began and just over six months ago this large-scale experimental installation was started up, with the results described above. The reaction being studied in ZETA is that in which deuterons (the nuclei of the heavy hydrogen isotope deuterium) collide with one another and fuse to form heavier nuclei, releasing energy and some neutrons in the process. For fusion to be possible the deuterons must have enough energy to overcome the initial electrical forces of repulsion between them. This necessitates heating the deuterium gas to temperatures of millions of degrees centigrade. The hot gas must be kept away from the walls of the container, otherwise it falls in temperature.

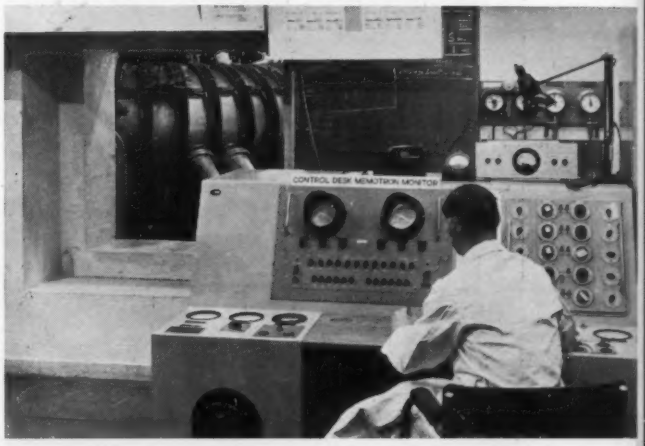
The principle adopted in ZETA is to pass a large electric current through the deuterium gas. This current sets up an electric discharge in the gas which heats it and also produces an intense magnetic field around the column of hot gas. This magnetic field causes the discharge to become constricted and hence heated still more. Since it also causes the discharge to wriggle about, this field by itself is not enough to keep the discharge away from the walls. The wriggling has been suppressed by applying an additional steady magnetic field parallel to the axis of the tube. The discharge chamber is a ring-shaped aluminium tube or torus of one metre bore and three

Part of the auxiliary electrical control equipment showing the capacitor room to the rear



Left: Control room for ZETA showing main control panel with eight-channel oscilloscope and health monitors

Below: Control desk "memotron" monitor in ZETA control room with part of the torus showing through the biological shield



metres mean diameter, containing deuterium gas at low pressure. The gas, usually at a pressure of about 10^{-4} mm of mercury, is made weakly conducting by a radio frequency discharge. The tube is linked by the cold-rolled grain oriented steel core of a large pulse transformer so that the toroidal ionised gas plasma forms what is, in effect, a short-circuited secondary winding. The ring-shaped discharge chamber itself is divided into two electrically insulated sections so that it has no current induced in it. A condenser bank capable of storing up to a maximum of 5×10^5 joules is discharged into the primary winding of the transformer and produces a unidirectional current pulse in the gas up to a maximum of 200,000 A. The current pulse in the gas lasts for about 4 millisec and is repeated every 10 sec. A steady axial magnetic field is generated by current-carrying coils wound on the torus and facilities exist to enable this to be varied from zero to 400 gauss. A vacuum spectrograph connected to the body of the torus is used to measure the temperature of the gas discharge. Throughout the current pulse the emission of neutrons is observed regularly in routine operation of ZETA with deuterium; up to 3×10^6 neutrons are emitted per pulse.

Temperature Measurements

The temperature of gas discharges may be determined from measurements on the light emitted by the gas atoms, but measurements of this kind in these experiments present problems because, at the temperature of the discharge, the hot deuterium atoms are completely stripped of their electrons and therefore do not emit a line spectrum. One method of solving this problem is to mix with the deuterium a small quantity of some heavier gas, such as oxygen or nitrogen, the atoms of which are not stripped of all their electrons under these conditions, and to study the spectral lines emitted by this impurity; the random motion of the high-energy impurity atoms, which make many collisions with the deuterium atoms and so reach the same energy, causes the spectral lines to broaden, owing to the Doppler effect, and the amount of broadening is a measure of the ion energy. Many measurements by this method have indicated temperatures in the region of 2 to 5 million degrees centigrade. Whilst temperatures in this range are required to explain the observed rate of neutron production on the basis of a thermonuclear process, electric fields in the gas arising from instabilities can also accelerate deuterium ions and lead to nuclear reactions. Such a process was described by Academician Kurchatov in his lecture at Harwell in 1956. Therefore, it is not altogether certain that the observed neutrons come from a thermonuclear reaction. Experiments are continuing to study the details of the neutron-producing processes.

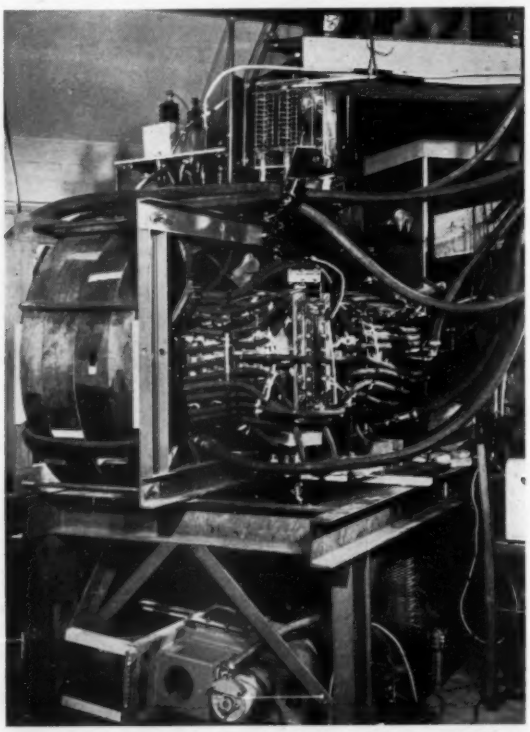
In order to obtain a net gain in energy from the reaction it would be necessary to heat deuterium gas to temperatures in the region of 100 million degrees centigrade, and to maintain it at this temperature long enough for the nuclear energy released to exceed the energy needed to heat the fuel and that lost by radiation. Lower temperatures would suffice for a deuterium-tritium mixture.

The work on ZETA has been done in the General Physics Division at Harwell which is under the direction of Mr. D. W. Fry. The group responsible for the work has been led by Dr. P. C. Thonemann and senior members concerned with ZETA have been Mr. R. Carruthers and Mr. R. S. Pease, with Mr. J. T. D. Mitchell of the

This apparatus is used for measuring the intensity of light emitted by the hot gas plasma in ZETA

Equipment for determining the source of the neutron emission

In "Sceptre III" the A.E.I. research team have achieved temperatures of nearly 4×10^6 deg C



Engineering Division, and Dr. W. B. Thompson of the Theoretical Physics Division. The principal contractors for construction were the Metropolitan-Vickers Electrical Co., Ltd. (who also collaborated in the design), British Insulated Callender's Cables, Ltd., and Telcon, Ltd.

Research work in the field of controlled thermonuclear reactions is also being carried out at the A.E.I. Research Laboratory (director, Dr. T. E. Allibone) on behalf of the U.K.A.E.A., and with the advice of Sir George Thomson. Experimental work was started at the Imperial College by Sir George Thomson in 1947. It was moved to the A.E.I. Laboratory in 1951. The senior members of staff engaged are Mr. D. R. Chick and Dr. A. A. Ware.

This work has recently culminated in a device which looks like a small edition of ZETA. This is known as "Sceptre III" and is an aluminium 12in diameter toroidal tube, the mean torus diameter being 45in; and it is threaded by an iron core weighing 4 tons. About three weeks ago temperatures of about 4×10^6 deg C were achieved with this apparatus and neutrons were observed. The work is being continued to see how far temperatures can be increased with smaller and less expensive systems.

Electricity and National Parks

SEVERAL pages in the 1956-57 report of the National Parks Commission (H.M. Stationery Office, 5s 6d) are devoted to the effect of electrical developments on the areas in which the Commission is interested. The first reference concerns nuclear power stations and mention is made of Parliamentary debates and statements relating to these. Satisfaction is expressed that the Electricity Act, 1957, includes provision for the preservation of amenity and it is stated that members of the Commission's staff have kept in close informal touch with officials of the Central Electricity Authority (now the Central Electricity Generating Board) for the discussion of plans at an early stage.

Particular concern has been engendered by the proposal to build a nuclear power station at Trawsfynydd, North Wales. This and its attendant transmission lines will, it is feared, be inconsistent with the maintenance of the area as a National Park. It is noted that an inquiry into the project is to be held. In the same area the Ffestiniog pumped storage scheme is under way and the Commission has discussed with the electricity authority the route for 275 kV lines between Ffestiniog and the Connah's Quay power station. The Authority has suggested a modification connected with the Trawsfynydd station; the Commission is not satisfied and consultations are proceeding.

Other electrical works which have been the subject of discussion are the supplies by the North Western Electricity Board to Great Langdale in the Lake District; the Hinkley Point nuclear power station; the proposed 275 kV Fleet-Drakelow line (temporarily in abeyance); the reinforcement of the electricity supply to the B.B.C. television station at Sandale Fell, Cumberland; the proposed Dockray-Glencoyne overhead line; an 11 kV line in the Yorkshire Electricity Board's area (for which a suitable alternative was found); and a line to Lord's Quarry, Elterwater (Lake District), for which an amended route was proposed by the North Western Electricity Board and accepted.

Power System Protection

A COURSE of eight lectures on "An Introduction to Protection of Electrical Power Systems" will be given by Mr. I. W. Morling on Tuesday evenings, commencing on 18th February, at Willesden Technical College. The fee for the course is £1 and inquiries should be made to the head of the Department of Engineering at the College, Denzil Road, London, N.W.10.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

"What Price Co-ordination?"

YOUR leader of 17th January on my article in the January issue of *Public Service*, suggesting the appointment of a Royal Commission to examine the whole field of fuel and power, calls for caution and comment.

In the first place the tenor of your article indicates a rash impatience with any suggestion for an examination of facts. You dispose of the minor aspects raised rather hurriedly, and, ignoring the major aspects, claimed to be worthy of, at least, examination, give the impression that by suggesting the gas industry is afraid of the future, you are uncertain of the effects of rationalisation on the electricity industry, do not welcome possible disturbance, and qualify for the well-known retort "Methinks thou doth protest too much." Further, your leader does not indicate appreciation of the fact that, as explained in my article, the views I expressed are my personal opinions. If you consult the *Gas Journal* of 29th May, 1957, you will observe I explained my outlook at a staff conference at Perth. There was no response then from the Under-Secretary to the Minister of Power, who was present.

If you will now consider the House of Commons debate on the reports of the gas and electricity industries (November, 1957) you will note that your charge that nearly all suggestions similar to mine emanate from the gas industry is far from true. Mr. Maudling, Mr. Nabarro, Mr. Wilkins and Mrs. Jeger all expressed the feeling that to "leave well alone" was unjustified, and that some measures towards co-ordination and administrative fusion of, for example, selling and accounting were at least urgently needed. Combined reading and billing might be quite economical and very acceptable to the public. Mr. Nabarro pointed out that the first nationalisation pattern for gas and electricity in France in 1946 took the form I recommend as a possible change for the future.

Your outlook seems restricted to the activities of gas and electricity. I am concerned with a much wider field in the national economy; these two industries certainly, but also the basic element coal, the position of oil and the future nuclear developments.

I would not be surprised if an independent inquiry came to the view that fusion of activity might even be necessary at the Boards of nationalised industries level. The annual report and account of the Ministry of Power might then under a co-ordinated policy discharge responsibility more efficiently in the public interest as against the present pattern where all the Boards can quite reasonably explain losses, rising prices, and criticism of inefficiency to the public, by the fact that each is not wholly in control of its own destiny.

By the absence of comment on the point I raise in connection with the position of employees, and particularly the aspect of a future outlook, whereby civil servants, nationalised industries and services employees, and local government officers may be recognised on an equal footing as "public servants," do I assume you are not adverse?

Instead of the last sentence in your leader, I suggest you announce a welcome to at least an impartial independent examination and keep free from the very dangerous practice of prejudging facts.

Glasgow, W.2. WM. B. MCARTHUR.

Fused Plugs

A NUMBER of leading manufacturers supply rectangular pin plugs fitted with 13 A fuses. Bearing in mind that these accessories are now being used extensively for domestic premises, I think this is, to say the least, unfortunate.

Probably nine out of ten householders will fit these plugs to flexes themselves, but how many will bother to change the fuses? Very few, I submit, especially when they find that the 13 A fuses so thoughtfully provided do not blow!

A householder who does decide to change his fuses finds himself landed with a pile of useless 13 A size. Not many people have more than one 3 kW load.

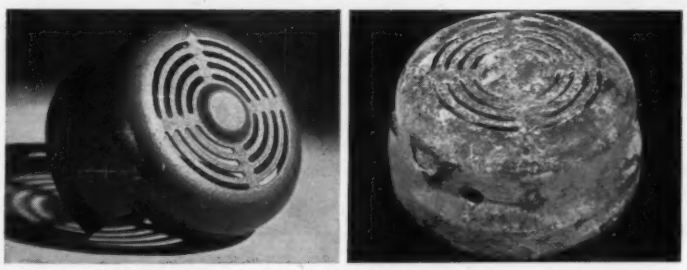
Long Ashton, Bristol. J. H. QUICK, B.SC.(ENG.), A.M.I.E.E.

Casings in Corrosive Atmospheres

IN his article "Electricity in the Chemical Industry" (*Electrical Review*, 10th January) Mr. S. Hardy has touched on a matter which is of considerable concern to the fertiliser and chemical industries, namely the tendency for manufacturers to substitute sheet steel and die-cast alloys for cast iron in motors, starters and distribution gear. Non-ferrous alloys are very rapidly attacked by fertilisers and even when coated with nylon or epicote resin varnishes are not reliable.

May I, through the medium of your journal, make a plea to all electrical manufacturers to continue the production of cast iron equipment for heavy industry, because at the present rate of progress it will be unobtainable in another few years. The accompanying photographs show a die-cast fan cowling heavily sprayed with nylon and the same after six months' exposure to damp and

Die-cast fan cowling before and after six months' exposure to damp and fertiliser dust



fertiliser dust, not in normal use, but merely hung up in a shed. I am quite sure these need no further comment, except to say that a similar cowling, unprotected, mostly disappeared in about twelve months, as did the fan blades.

Ipswich, Suffolk. J. B. HAYES.

Unshaded Street Lamps

I WOULD take issue with Mr. W. Robinson's implication that the same sort of directional control can be applied by refractive lenses or hoods (on street lamps). There may be a measurable drop in light intensity from the refractor at the " cut-off " design angle, but due to source size, imperfections in lenses and reflectors, and dust, the effect is still to hang a brilliant light in the sky. The same strange thinking pervades car headlamp design—a muddy road negatives half of the lamp designer's effort.

I realise, of course, that the economic argument is the strongest one (shaded lamps must be closer spaced) but in this matter I think that road safety should take precedence.

The same principle lies behind my support of the sodium lamp. It is the best light in fog by far, and it is the only lamp that I, at least, can look at without discomfort while still seeing the background. It seems to me that the reason may be partly physiological and associated with the colour, rather than a simple intensity effect, but I have never seen any reference to this particular aspect.

I am very surprised to find that in this important matter of street lighting no official guidance is given on a choice of systems to local authorities, who may or may not be competent to make the right choice. Surely a " Code of Practice " is long overdue.

Cheadle, Staffs. C. R. CADMAN.

The Institution and its Members

THE leading article in your issue dated 27th December, 1957, calls attention to a difficult problem that, probably, must face any organisation such as an engineering institution once it grows beyond a certain size. Clearly it is undesirable, and in conflict with the aims of such an institution, that to the majority of its members corporate membership should mean no more than, as you put it, " a qualification necessary to a successful career." But this tendency is now plain for anyone to see.

Membership, ideally, should be active; members should contribute something more to the organisation than just their subscription, and should receive something more from the organisation than just the cachet of membership. But, to take the Institution of Electrical Engineers as an example, how is the ordinary member to do this ?

The number of members who can participate directly in the activities of the Institution by regular, or semi-regular, attendance at main or subsidiary meetings will always be limited by circumstances (at least, that is the opinion of the writer but it should not be too difficult, and it would be of interest, to find out fairly exact figures by means of a survey of representative groups of members). Other members, therefore, can hope to participate only in mainly indirect fashion by reading, and by contributing to, the publications of the Institution.

However, consider the type of paper that now forms the bulk of the publications of the Institution. In general, the authors are either giants of the profession, men engaged in research, or men engaged in very specialised work. In discussions on such papers, only men of equal calibre, or of similar specialised interests and knowledge can, with propriety, hope to join in. In too many cases the ordinary " bread and butter " member can only sit back respectfully dazed, or just uninterested, as the case may be; and can he justly be blamed for this ?

The one field in which most ordinary members could be expected to be able to contribute something of interest and possible value lies in the problems they meet, and the opinions they come to hold, during the everyday practice of their profession. Individually, no such items are likely to merit the dignity of even a short I.E.E. paper but several of such items could well arouse quite widespread interest and useful discussion. Conflict of opinion is nearly always stimulating and interesting.

What seems to be required is an engineering forum on the lines of the correspondence columns of your distinguished contemporary *The Listener*, with the ball set rolling by short descriptive articles or statements of opinion, and participation in the lists confined, mainly, to chartered engineers with something pithy and constructive to say. Whether it would be better for these to be separate for each engineering institution, or a combined forum for them all, or even both separate and combined forums, is for someone more expert than your correspondent to decide.

Kirkuk, Iraq. H. W. S. MARSHALL, A.M.I.E.E.

[Our correspondent overlooks a patent fact: that the obvious " forum " for the discussions he envisages is the *Electrical Review*. Our columns are always open to those who wish to put their views before fellow-members of the electrical profession and industry—as Mr. Marshall is now doing.—Editors, *Electrical Review*.]

Information on Insulation

MR. A. R. NISSER, on page 63 of your issue of 10th January, suggests a need in this country for a central non-profit-making organisation to diffuse knowledge of electrical insulation. Listing several German and American organisations thus engaged, he implies by omission that similar bodies are not active in Britain.

One may well agree with Mr. Nisser on the importance of the subject to the electrical industry, and wish that more effort could be given to research and information in this field, but can he be unaware of the existence of the British Standards Institution and the Electrical Research Association ? Both these are central non-profit-making organisations engaged in providing research, standardisation and diffusion of knowledge relative to insulation, among other subjects.

The E.R.A. allocates, in addition to overhead costs, some £30,000 per annum to insulation research, industrial and academic. During the six years 1951-56 it issued over 150 reports in this field, of which at least 13 are now embodied in British Standards for insulating materials.

The British Standards Institution issues a considerable number of such specifications and revisions every year. In addition, its committees on insulation form the British " National Committees " of relevant sections of the International Electrotechnical Commission. The E.R.A. is directly represented on six committees of the I.E.C. and C.I.G.R.E. dealing with various aspects of insulation.

If Mr. Nisser is aware of this position, but thinks it inadequate for the needs of industry, an opinion from which I would not dissent, his most effective remedy is to advocate more financial support from the firms who benefit from these activities. The amount of work which can be undertaken is limited only by the available funds.

Leatherhead, Surrey. C. G. GARTON, F.Inst.P., M.I.E.E.,
Materials Department,
Electrical Research Association.

General view of the E.D.A. stand at the Hotel and Catering Exhibition

Electrical Catering

NEW EQUIPMENT ON SHOW AT OLYMPIA

CONVINCING evidence of the versatility of electricity in satisfying the needs of Britain's fourth largest industry is clearly demonstrated at Olympia, London, in the 1958 Hotel and Catering Exhibition which closes to-day (Friday). Of the 250 or so trade stands a very high proportion is devoted to electrical apparatus for the catering industry in the form of refrigeration equipment, food preparation machines, cooking equipment, etc., much of which is on show for the first time.

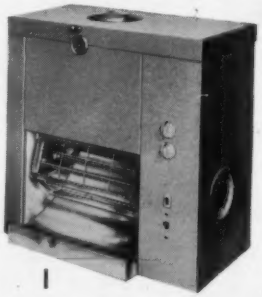
One of the most comprehensive displays is that of the British Electrical Development Association, whose stand is divided into three main sections: a canteen kitchen suitable for catering for 250 people; a small restaurant kitchen; and a small buffet or snack bar. Among the many appliances in the canteen kitchen are such items as a chip cutter (Crypto); cooking range, stock-pot and griller (G.E.C.); potato peeler and gravity slicer (Hobart); pastry oven (Jackson); and a steaming oven and a fish fryer (Simplex). The smaller kitchen display includes a "Rotapan" steam cooker (Crypto); washing-up machine (Hobart); gravity slicer and potato peeler (Peerless & Ericsson); and a deep-fat fryer (Stott). Examples of the latest developments in electric cooking, infra-red grills, by Turmix, M.E.A.C. and Brattel, are to be seen in the snack bar as well as a deep-fat fryer (Kelly), a bain-marie and a 10in griddle plate (Electro-way), a twin coffee unit (Cona), and a Frigidaire counter-top display.

On the E.D.A. stand attention is also drawn to two other electrical appliances which play an important part in hygiene—the water heater, which provides adequate hot water for washing utensils and the hands of the staff, and the refrigerator. In this display may be seen a Frigidaire 15 cu ft refrigerator as well as a deep-freeze unit and a 100 cu ft cold room (both Prestcold). There are sink water heaters by Jackson and Santon and a Stott wall mounted water boiler.

Claimed to be the heat source of the future, the new "Osram" quartz infra-red lamps, to be seen on the G.E.C. stand, provide an extremely high temperature in two to three seconds and can lead to faster cooking. Besides withstanding intense heat, quartz also has a good resistance to thermal shock and cold water may be poured on to the hot bulbs without damage. Although the lamps give off some light, the majority of the radiant energy is in the form of infra-red rays. As well as future applications in the catering industry, these lamps are finding many new uses in industry where their particular advantages of rapid heating or drying can be put to good use. Two ratings are available, 500 W for operation from 100/130 V and a 1 kW unit for 200/250 V, and the life is claimed to be 5,000 hours.

On this stand there is also a new 15 cu ft refrigerator, available in two types, one of which is suitable for ice making. The non-ice-making model has a plate type evaporator while the ice-making version has a cavity

1. *Simplex "Creda" radiant continuous toaster.* **2.** *One of the new range of Stotts water heaters*



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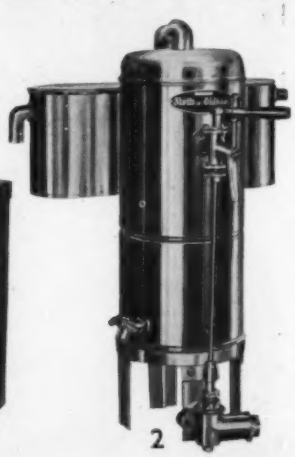

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evaporator with accommodation for six standard ice trays on three refrigerated shelves. In addition there is a new ice-making unit designed to make 108 1in ice pellets at each freezing. A polythene container housed below the freezer will hold and keep 600 of the ice pellets in a dry state indefinitely.

The G.E.C. also offers the caterer a new single-oven range (model HO12), designed to cook for about 40 persons. The oven is thermostatically controlled while the hotplates are controlled by three-heat rotary switches. Construction is such that units can be joined to make double or multi-oven ranges.

Approximately 400 hamburgers an hour, or 12 chops every ten minutes, can be cooked on the new G.E.C. griddle plate with automatic temperature control. The top plate is of cast iron and its cast-in groove enables surplus fat to drain away to a removable drip pan. A bench mounting hotcupboard, suitable for back-bar use is yet another new G.E.C. product. It can accommodate 48 plates or 24 meals on plates and with a maximum loading of 800 W is suitable for use from any 13 or 15 A socket outlet. It is thermostatically controlled, fitted with a pilot light and finished in cream with a black hob.

Apart from items of cooking equipment, the company have on view a new polisher-scrubber, a room air-conditioning unit and two new non-corrodible lighting fittings. The "Genalex" polisher-scrubber, although designed primarily as a polisher, is converted into a scrubber simply by the addition of a tank. Constructed of rustless alloys, its brush mechanism is driven by a belt from a ¼ h.p. motor for quietness. The room air-conditioning unit is for medium and high ambient temperatures, and incorporates a reverse-cycle heat pump, which automatically changes the refrigeration cycle according to the rise and fall of the room temperature. The lighting fittings are for use in food factories and other installations where corrosive vapours are present, and are largely of plastic construction and have no external metalwork. A new method of suspension ensures a satisfactory seal without the use of fixing screws by allowing the weight of the fitting to perform the clamping action.

With a capacity of 500 slices per hour, the new "Creda" radiant continuous toaster is one of the main attractions on the Simplex Electric Co.'s stand. Designed to meet the requirements of restaurants, industrial canteens, snack bars, etc., it produces bread evenly toasted on both sides at once. In hotels particularly, it has a useful application in providing an instant service as the guests enter the dining room. Strongly constructed, the toaster may be table mounted, or supplied with a stand, and being of convenient dimensions (30in sq by 18in deep) it is easily carried. The total loading is 7 kW (4 kW constant and 3 kW "Simmerstat" controlled).

Another new "Creda" appliance is an open bain-marie designed to fit the dimensions of the "Creda" unit and "Chef" type ranges. It is constructed of stainless steel and the heaters are placed in a well to ensure maximum efficiency. A useful additional facility is the perforated tray, also of stainless steel, designed for egg boiling in quantity. The tray has lifting handles so that the eggs may be removed together. The water is heated by "Redhead" thermostatically controlled immersion heaters. A strong removable pot rack is incorporated in the lower part of the bain-marie. In the *à la carte* section of their stand "Creda" demonstrate their "Chef" range with solid boiling top. This appliance also appears on the stand of the Hotel and Catering Institute, who have chosen it for their demonstration theatre.

Modifications have been made to the standard "Creda" hotcupboards, steaming ovens and salamanders to further improve their performance. Because they have a particular application to the hotel and boarding house trade the company also exhibits its recently introduced range of "Calypso" convector heaters, in 750 W and 2 kW sizes.

Two new bench-type mixers, EB.12 (12 qt) and EB.2012 (20 qt), supplement the well-known range of mixers and general purpose machines displayed on the Crypto stand. Powered by ¼ h.p. and ½ h.p. motors, respectively, each model has three-heat control and is provided with a size 12 hub to accommodate mincing, slicing and shredding attachments. Although primarily used in bakehouses and kitchens, this type of machine has a wide industrial application for any type of mixing. An interesting display of heavy duty cooking equipment, as well as counter and sink units, are on show on the Falkirk Iron Co.'s stand, while Benham & Sons introduce many new designs in their selection of cooking apparatus, kitchen and service equipment. Stainless steel is emphasised in their combination wash-up and sterilising sink unit. The Jackson Electric Stove Co. introduces a new pastry oven of modern design with heating elements at the top, bottom and sides to ensure even cooking. One-, two- and three-tier models are available.

The original Stotts of Oldham "Minor" boiler has been known to the catering trade for many years and its success has prompted the company to add two further sizes, the "Medium" and "Major," to give a new range of boilers to suit most catering requirements. The "Minor" boiler now has an improved output from 120 to 150 pt/hr. The "Medium" has an output of 300 pt/hr and the "Major" 425 pt/hr. In addition Stotts introduce for the first time a new range of stainless steel electric water boiling urns.

Two new attachments for the Kenwood "Major" and "Chef" food mixers, a continuous and a high-speed juice separator and a high-speed slicer and shredder, are being demonstrated for the first time. Other Kenwood exhibits include the "Activair" portable heater and air conditioner and their latest development, the "Rotisserie" table top electric cooker, suitable for grills, roasts and even spit-rotated poultry. For the hotel laundry the company has on view two models of its "Sun-Dry" spin dryer. Spin dryers are also shown on the Chilton Electric Products' stand, where it is demonstrated that the "Chilton" spin dryer can not only dry clothes but is also useful for drying potato chips before frying. In holiday hotels the guests might also appreciate the facilities of a spin dryer to dry wet swim-suits and children's clothes.

Hoover show a full range of their cleaning products as used in the catering industry, among them their model 912 heavy duty cleaner, which is especially reinforced for hotel carpet cleaning. On their stand Columbus Dixon have on view their heavy and medium duty power operated cleaning machines.

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1. G.E.C. bench-mounting hotcupboard. 2. Kenwood "Rotisserie" portable cooker. 3. Crypto model EB.2012 mixer

INDUSTRIAL NEWS

U.S. Comment on ZETA

Reuter reports from Washington an interview with Mr. Lewis Strauss, chairman of the United States Atomic Energy Commission, and American atomic scientists upon the announcement of the results obtained from the "ZETA" equipment at Harwell. Mr. Strauss said that he would not describe development so far as a "major breakthrough" and Dr. Willard B. Libby, another member of the Commission, said that what had been accomplished was "a major step forward, but not a major breakthrough." Mr. Strauss objected to suggestions that the United States had asked for the release of the information to be delayed to give American scientists a chance to "catch up." Dr. Libby stated that the British and American experiments were "so neck-and-neck" that there was no difference. "Both have produced a large amount of neutrons," he said, "but on neither side of the Atlantic is there any certainty that these are thermonuclear neutrons."

Mr. Strauss emphasised that the production of power by fusion reaction was so far away that it would not interfere with the production of power by fission processes and the world's requirement for uranium was not affected by this research.

Accommodation at Brighton

Individual delegates to the British Electrical Power Convention at Brighton (16th to 20th June) are finding it difficult to secure hotel accommodation for the period. It is erroneously thought that there has been block booking by the Convention Council but actually this applies only to the "headquarters" hotel—the Grand. Those who have been unable to obtain accommodation are advised to seek the help of the Director of Publicity, Royal York Buildings, Brighton (telephone 29801).

Through the courtesy of the Brighton Corporation the Electrical Exhibition in connection with the British Electrical Power Convention will be held in the West Street Car Park. The site, which is adjacent to the Sports Stadium, covers 23,000 sq ft.

Transformers for America

Crompton Parkinson, Ltd., has secured an order from the United States for six power transformers valued at upwards of $200,000. The transformers are each of 8,687 kVA, single-phase for 115 kV service voltage and are to be employed in the Fremont Canyon power project in Wyoming. The order was obtained in the face of strong competition from manufacturers in America, Austria, Italy and Switzerland, as well as Britain. The transformers will be built at the company's B.E.T. transformer works at Hayes, Middlesex, during the next sixteen months.

Music by Wire

The Postmaster General announces that he is prepared to consider applications from private persons and companies for licences to distribute music by wire. The licences will allow persons and companies to operate music distribution centres and wire networks for sending their own programmes of recorded music to business premises such as shops, restaurants, offices and factories, but not to private homes. "Live" or recorded radio broadcast programmes, advertisements and propaganda will not be permitted. The area over which music may be distributed will be defined in the licence.

Licensees will themselves have to provide the wires from the music distribution centres to their customers' premises but where the Post Office has spare wires they may be rented for linking music distribution centres one with another. A number of companies and individuals have already shown that they are interested in introducing music services.

Turbo-Alternator at N.P.L.

A geared 650 kW turbo-alternator set made by the General Electric Co., Ltd., has recently been installed at the National Physical Laboratory, Teddington, as part of a scheme for heating the laboratories and, at the same time, economically augmenting the electricity supply to the site. The set is usually operated in parallel with the South Eastern Electricity Board's supply, but in the event of a mains failure occurring the essential services of the laboratory can be maintained.

The turbine, with inlet steam conditions of 210 p.s.i. at 540 deg F, is designed for back-pressure operation. Exhaust steam at 40 p.s.i. is desuperheated and delivered to calorifiers for central heating purposes. To ensure that the heating requirements can be met under all conditions of electrical load additional steam for space heating can be supplied via a by-pass line with a reducing valve and desuperheater. When the set is synchronised with the grid, the back-pressure is maintained constant by a pressure regulator, the electrical output varying according to the demand for heating steam.

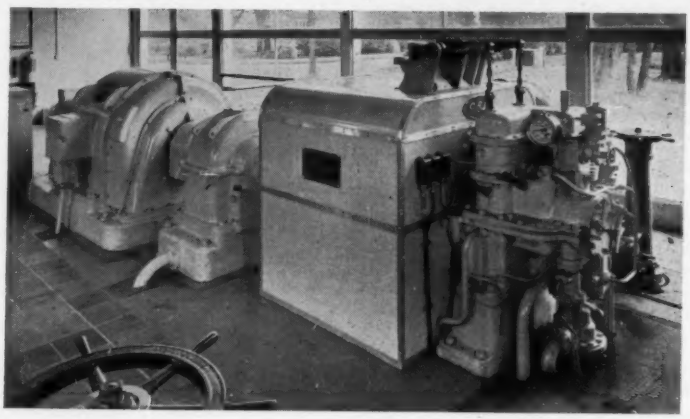
Trade Fairs in France

The procedure which will be followed for the allocation of licences by the French Government for goods from the United Kingdom which are exhibited at French exhibitions and fairs in 1958 was summarised in last week's *Board of Trade Journal*. Importers wishing to participate in the special quota of licences for this year's fairs should submit a preliminary application covering their requirements for the whole year by 12th February next to the Commercial Department of the British Embassy in Paris. The full French text may be seen at the Export Services Branch, Board of Trade, Room 722, Lacon House, Theobalds Road, London, W.C.1, and a translation will be circulated later through the Special Register service.

Elliott Brothers (London) Agreement

Elliott Brothers (London), Ltd., announces the conclusion of an agreement with the Holtzer-Cabot Motor Division of the National Pneumatic Co., Inc., of Boston, Massachusetts,

G.E.C. 650 kW turbo-alternator installed at the N.P.L.



U.S.A., for the manufacture of many of the Holtzer-Cabot instrument motors in the United Kingdom. The types of motors to be manufactured, to meet the special requirements of the European and British markets, include precision electric servomotors for strip recording instruments, timing devices and electronic control systems of all kinds, and also general-purpose ranges of industrial induction and synchronous fractional-horse-power motors for industrial purposes. Elliott Brothers, in addition to manufacturing the Holtzer-Cabot instrument motors for their own equipment, will make these motors available to other instrument manufacturers through their offices in most of the Commonwealth and Europe.

Cut in Aluminium Production

Because, it is said, the state of stocks and the immediate demand for the metal do not justify full operation, Aluminium, Ltd., intends to reduce primary aluminium production at its Canadian smelters to 80 per cent of the rated capacity. As a beginning, Aluminum of Canada, Ltd., was to close down last week-end plant at the Arvida and Shawinigan works with an annual output of 60,000 tons.

Housecraft Advisers' Conference

The annual four-day conference of electrical housecraft advisers and senior demonstrators, organised by the British Development Association and the Electrical Association for Women, was concluded last Friday at

Miss Mary George presenting the Elizabeth Sloan Chesser cup to Miss Elizabeth Giles

the Connaught Rooms, London, with a general discussion followed by a luncheon. As reported in last week's issue, the conference was opened on 21st January by Sir Josiah Eccles, deputy chairman, Electricity Council. Mr. J. I. Bernard, director, E.D.A., and Miss Mary George, director, E.A.W., then spoke about the 1958 campaigns of their respective organisations. During the afternoon the subject "Selling the Home Laundry" was dealt with, several speakers participating.

On Wednesday the chief interest was a visit to the Hotel and Catering Exhibition at Olympia, which followed a talk by Mr. H. Gamble (Eastern Board) on "What to see at the Exhibition." Thursday's theme was electric cooking and the speakers included Mrs. Marguerite Patten (B.B.C.) and Miss Joan Whitgift (Simplex Electric Co., Ltd.).

The Elizabeth Sloan Chesser Cup, awarded annually by the E.A.W. to the best candidate in their examinations, was this year won by Miss Elizabeth Giles (South Western area demonstrator, Jackson Electric Stove Co., Ltd.).

Pumps for Hinkley Point

Hayward Tyler have received from Babcock & Wilcox, Ltd., an order for forty-eight glandless circulating pumps to be incorporated in the heat exchanger circuits of Hinkley Point nuclear power station. These pumps are similar to those on order from Hayward Tyler for Berkeley, Bradwell and Hunterston nuclear power stations. The approximate value of the contract is £125,000. Hayward Tyler are members of the Platt Brothers Group.

Consolidation of Patents Rules

Amended rules making minor changes in the arrangements governing patent applications and fees have been laid before Parliament by the Board of Trade. They include the introduction of a new service to the public by which information will be supplied as to whether any particular patent is in force on payment of a nominal fee of 1s for the first patent and 6d for each succeeding one. This service will replace the former annual publication "List of Patents in Force."

Development Station Opened

To extend its activities in the chemical engineering and automatic control fields, Constructors John Brown, Ltd., has recently established a research and development station at Leatherhead, Surrey. The primary object of the station will be to undertake sponsored development work on behalf of Government Departments and industrial organisations, and also for the engineering and construction divisions of the company. It will cover the following fields:—Process development and investigation of chemical engineering problems; development of automatic control systems and their application; and problems of nuclear engineering.

New Lighting Fittings Showroom

Hiscock, Appleby & Co., Ltd., was founded by Mr. R. Hiscock about five years ago to manufacture lighting fittings and occasional furniture. To-day the company has three factories and to these have now been added new showrooms, opened recently, at 12-16, Holbein Place, Sloane Square, London, S.W.1, in which a representative display of the company's designs of lighting fittings can be seen. The designs are mainly modern in conception, but they are classically simple to harmonise with traditional or contemporary surroundings, and the extensive range includes designs suitable for both large and small homes. There are also many fittings designed for shops, offices, hotels and other public buildings.

Employee was a Contractor, Too

John Barr (38), an electrician, admitted at the Belfast Custody Court on 10th January, that whilst employed by Electrical Installations, Ltd., at Larne, he defrauded the firm of £19 1s 8d by taking on a private contract and getting the work done by another employee of the firm, whose wages were paid by the firm.

Mr. J. H. Campbell, R.M., said it was an entirely new form of crime which he had never met before. Detective Constable O'Brien said it was going on wholesale, but not by this man.

Mr. J. Twinem, foreman at the Larne branch of the firm, described Barr as a first-class, conscientious worker, and Mr. David Gordon, for Barr, said he had made full restitution. He pleaded previous good character in mitigation.

The Resident Magistrate imposed a fine of £10.

Nuclear Engineering Course

An Easter vacation course on "Basic Principles of Nuclear Engineering" will be held from 13th to 19th April at the University of Liverpool. Particulars can be obtained from the Director of Extra-Mural Studies, 9, Abercromby Square, Liverpool, 7.

Electrical Commercial Travellers

The annual luncheon of the Electrical Trades' Commercial Travellers' Association will be held at the Connaught Rooms, London, W.C.2, on Friday, 21st February (12.45 p.m.). The closing date for obtaining tickets is 11th February, and applications should be made to Mr. F. J. E. Simons, 42, Lower Barn Road, Purley, Surrey.

Floating Crane Plant

The General Electric Co., Ltd., has received a contract for the electric power equipment for a floating crane which will use the same diesel-electric plant both for propulsion and for crane operations. This 60-ton, twin-screw floating crane is being supplied by Lobnitz & Co., Ltd., to the Mersey Docks and Harbour Board. Two engine-generator sets will be installed, each consisting of a Ruston & Hornsby 12YL supercharged engine driving a 330 kW, 440 V, 600 r.p.m. open type propulsion generator and a 300 kW, 220 V open type auxiliary generator in tandem. Each main generator will supply independently a 400 h.p., 120 r.p.m. propulsion motor direct-coupled to one propeller, and the control system, operated from the bridge, will provide five speed notches in each direction. To assist manœuvring, a third screw in an athwartships tunnel will be driven through gearing

by a 210 h.p. motor supplied from either auxiliary generator. A Ward-Leonard set, supplied from the auxiliary busbars, will provide power for the hoist, auxiliary hoist and derricking of the crane. Power for the slewing and travelling ballast motors will be taken direct from the auxiliary bars. Protection will be provided against the diesel engine being overloaded by the full crane load being applied during propulsion, only slewing and hoisting being available in these circumstances.

Balfour, Beatty Overseas

Balfour, Beatty & Co., Ltd., has formed a wholly-owned subsidiary company named Balfour, Beatty (Overseas), Ltd., which will qualify as an overseas trade corporation for the purposes of the Finance Act, 1957. The business of civil, mechanical and electrical engineering contractors carried on by Balfour, Beatty & Co., Ltd., in East Africa, Iraq and Malaya will be undertaken by the new company, which will be under the same management and direction as Balfour, Beatty & Co., Ltd.

Japanese Atomic Power Mission

Members of the mission representing the Japan Atomic Power Co., now in Great Britain, on 22nd January visited the Renfrew Works in Scotland of Babcock & Wilcox, Ltd., a member of the English Electric-Babcock & Wilcox-Taylor Woodrow Atomic Power Group.

E.I.B.A. Cornwall Branch

The inaugural meeting of the Cornwall Branch of the Electrical Industries Benevolent Association was held at Truro on 20th January. Mr. A. E. Gladwell, a prominent local wholesaler and the convener of the meeting, put the proposition that a branch be formed, and the resolution was carried unanimously. He was then formally elected chairman of the Branch, and Mr. C. J. Hocking, manager of the Cornwall Sub-Area of the South Western Electricity Board, was elected vice-chairman. Mr. F. O. Pascoe, of the Electricity Board, who had already acted as secretary in the preliminary arrangements but was unable to attend the meeting through illness, was appointed hon. secretary, and Mr. A. Westcott, a contractor from Perranporth, was elected hon. treasurer. Mr. H. F. Wickham, deputy secretary of the E.I.B.A., welcomed the formation of the Branch and outlined the activities and progress of the Association.

SPIN AND TUMBLER DRYERS

In our series of domestic electrical equipment surveys we shall be dealing next week, for the first time, with spin and tumbler dryers. Details to be given, in tabulated form, will include type, size, clothes capacity, loading, speed, finish, price, etc. Electric irons will be reviewed in our issue of 21st February

Left to right: Mr. H. M. Loader; His Excellency the Liberian Ambassador; Mr. H. B. Fahnbuller (his First Secretary); Mr. H. F. Yelland (director, Brush Exports, Ltd.); and Mr. R. G. Hooker (director and general manager, Brush Electrical Engineering Co., Ltd.) during the Liberian Ambassador's visit to Loughborough

Zinc Alloy Die Castings

Last week we attended an open day held by the Zinc Alloy Die Casters Association at 34, Berkeley Square, London, W.1. The film "Die Casting—How Else Would You Make It?" was shown and among the publications available was the recently published "Engineering Standards for Pressure Die Casting." A list of current publications is available from the Association.

Locomotives for N.C.B.

The Metropolitan-Vickers Electrical Co., Ltd., has supplied many battery locomotives to various collieries of the National Coal Board, and recent orders have been for collieries in the Scottish Division. The first of these was for two 14-ton flameproof battery locomotives for use at Rothes colliery; these have now been commissioned and a further two locomotives have been ordered for the same colliery. Six locomotives of the same type are also on order for Bilston Glen colliery.

Cable-making Machinery for Jugoslavia

A contract from Jugoslavia for a complete line of cable manufacturing machinery has been secured by Fawcett-Finney, Ltd., the sales organisation of two of the Metal Industries group of companies, Fawcett Preston & Co., of Bromborough, Ches. (who are manufacturing the equipment), and Finney Presses, of Birmingham. The order, placed by Fabrika Kablova, is valued at £25,000; delivery of the plant is scheduled for March.

Works Visit

On 21st January His Excellency the Liberian Ambassador, Mr. C. L. Simpson, visited the Brush Electrical Engineering Co., Ltd., works at Loughborough. Earlier this year the Brush Group obtained an order worth more than $250,000 from the Liberian Government for diesel-electric generating sets for the Monrovia City power station. The generator sets consist of KSS8 diesel engines made by Mirrlees, Bickerton & Day, Ltd., and generators and switchgear made by the Brush Electrical Engineering Co. This is said to have been the first time that Liberia has bought British electricity supply equipment.

Trade Announcements

The **Bowthorpe Electric Co., Ltd.,** has announced its new sales policy with Tate Engineers, Ltd., Portslade-by-Sea, Sussex, as from 1st February. Mr. C. F. Heywood will represent both companies' interests in the areas of the North of Scotland Hydro-Electric Board, South of Scotland, North Eastern, North Western, and Merseyside and North Wales Electricity Boards. Mr. W. A. Canfield will cover the areas of the South Wales, South Western, Southern and South Eastern Electricity Boards and London, and Mr. J. M. Patrick will cover the areas of the East Midlands, Yorkshire, Midlands and Eastern Electricity Boards.

Elliott Brothers (London), Ltd., who had a special department for the general sales and servicing of American-made Bendix aviation and radio equipment, have discontinued this department. They will concentrate on the manufacture in this country under licence of the range of Bendix-designed equipment and on its sale and servicing.

Belling & Lee, Ltd., have appointed Mr. R. W. Elliott, D.F.H., Graduate I.E.E., as senior technical representative of the company to manufacturing and Government interests.

Mayall & Co., Ltd., electrical wholesalers, have moved to new premises at 57, Park Street, Birmingham, 5 (telephone: Midland 1721/2/3).

The sales office of the **Aluminium Wire & Cable Co., Ltd.,** will be 2, St. James's Square, London, S.W.1 (telephone: Trafalgar 6441), from 1st February.

The telephone number of **Hirst Electronic, Ltd.,** has been changed to Crawley 25721-2-3.

NEW ELECTRICAL EQUIPMENT

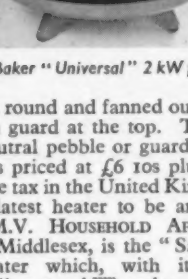
Fan Heaters

A new fan heater, dimensionally identical to the "Elfin" model recently produced, has just been announced by P. W. BAKER (SALES), LTD., Eastergate, Chichester. The new heater, the "Universal," has a higher loading than the previous model (2 kW) and can also be mounted on a wall. It is provided with an open wire guard at the top instead of an expanded metal grille as on the "Elfin." With this new model cool air is drawn in

P. W. Baker "Universal" 2 kW fan heater

from all round and fanned out through its open guard at the top. The finish is in neutral pebble or guardsman red and it is priced at £6 10s plus £2 17s purchase tax in the United Kingdom.

The latest heater to be announced by H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middlesex, is the "Salisbury" fan heater which, with its 3-heat control (½, 1 or 2 kW) and 3-speed fan, enables up to twelve combinations of heating and cooling to be obtained. It can also be used as a hair dryer or for airing clothes. It measures 15in high by 11in wide by 7in deep and the total weight is only 7¾ lb. A choice of finishes includes red and black, gold and ivory and stone and black. Models are available for the 200/220 and



H.M.V. "Salisbury" fan heater

230/250 V ranges, a.c. only, and the price is £6 18s 8d plus £3 0s 10d purchase tax in the United Kingdom.

Domestic Refrigerators

The 1958 range of domestic refrigerators manufactured by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2, carry the Hotpoint script in place of the "Coldrator" badge and to each model—the C36 (3·6 cu ft), C50 (5 cu ft) and CS81 (8·1 cu ft)—is attached a seal with the words: "This is your 'Coldrator' refrigerator by Hotpoint."

The new models are powered by the Hotpoint hermetically sealed compressor, claimed to be the smallest and most compact of its kind. They incorporate a stainless steel freezer and enamel chip-proof and scratch-proof shelves. The exterior finish is in cream or white and the one-piece interior linings are of ice blue polystyrene. The C36 and C50 models are available either as build-in types (without table top) or with vitreous enamel table tops in attractive colours.

On all models a new feature is a glide-in safety door latch of a type compulsory in the United States for the protection of small children who might shut themselves inside. A touch on the inside of the door will open it, yet the handle is so rigid that it cannot become loose or rattle.

Both the C36 and C50 models are provided with a hinged half-shelf and, additionally, the C50 has two shelf

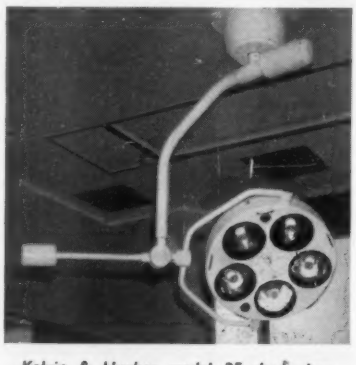
Hotpoint model C36 3·6 cu ft refrigerator

positions. The C36 has a bacon keeper in the door, the C50 has butter and cheese compartments, and both models have an egg rack and bottle shelf. An additional feature in the C50 is an automatic interior light. The CS81 has a full-width evaporator holding 42 lb of frozen food, a spacious chiller and a thermostatically controlled "Buttador." The shelf area is 14 sq ft, there are two salad containers and ample storage for eggs and bottled products in the door.

The prices of the build-in models, without table tops, are £75 12s (C.36) and £91 7s (C50). The table tops are £3 3s extra. The CS81 is priced at £157 10s. All the foregoing prices include purchase tax in the United Kingdom.

Shadowless Lighting Fitting

Following extensive tests in two London hospitals the new model 36 shadowless operating theatre lighting fitting, manufactured by KELVIN & HUGHES INDUSTRIAL, LTD., 2, Caxton Street, London, S.W.1, is now being made available. It has five large aluminium reflectors totally enclosed in a metal housing. These reflectors are electrolytically polished and anodised to give a hard non-tarnishing and scratch resistant surface. The complete fitting is designed for easy servicing and its non-splintering glass windows are rubber sealed to prevent entry of dust or fumes. Five-fold infra-red filtering is used to absorb the radiant heat without obstructing the light and the special design of the reflectors has achieved a light intensity of 1,800 lm/sq ft at 42in with a total consumption of only 220 W. This low wattage prevents an unnecessary rise in the ambient temperature of the theatre. By using 24 V, through a transformer, the fitting not only conforms to Ministry of Health recommendations, but in addition the light field and intensity do not change when the fitting is



Kelvin & Hughes model 35 shadowless lighting fitting

switched over to the emergency supply.

Its friction-damped counterbalanced suspension enables the light beam to be positioned positively at the touch of a finger and an external remote control permits quick and accurate fixing of the reflector unit for variations in distance. Space between the reflectors is provided to enable special equipment to be added, e.g., a camera to take colour transparencies, television, ciné, etc.

Horticultural Heating Tape

A recent product of FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1, is a form of electric heating tape suitable for installation in a greenhouse bench or cold frame and for other horticultural purposes. The tape, supplied in 16ft lengths, consists of two resistance wires which are woven into a fibreglass covering. This is covered by an extrusion of heat resisting p.v.c. to

form a tough, flat, pliable heating element. The graduated lengths are then high frequency sealed at one end, the other end terminating in 9ft of flexible lead. This termination is made to the element by injection moulding and is claimed to be completely waterproof. The loading, at a maximum of 250 V, is 80 W and the price is £1 9s 6d.

Cable Markers

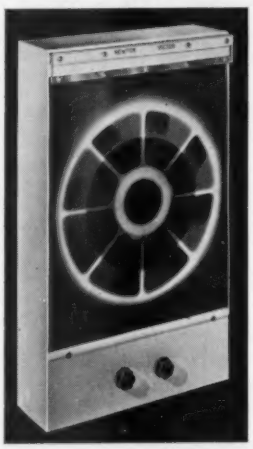
The most recent addition to a range of identification devices manufactured by CREATORS, LTD., Plansel Works, Sheerwater, Woking, Surrey, is the "Clip Marker," a plastic moulding which is designed to clip on to a cable. It is provided with interchangeable paper or plastic shields which can be supplied either pre-printed or blank so that users can write or print their own code on to them.

The standard model can be used anywhere along the length of a cable but an alternative design is available which acts as a binding sleeve and can be pushed on to a cable end. Both types are in a wide range of colours and sizes.

Radiograph Illuminators

"Maxilume" illuminators for examining radiographs up to 14in by 17in (35 by 43 cm) have been introduced by NEWTON VICTOR, LTD., X-ray Department of Metropolitan-Vickers, Trafford Park, Manchester, 17. A feature of the illuminators is the use of 15 W 18in colour-matching fluorescent lamps giving an evenly diffused, glareless light of true north daylight character with a complete absence of flicker.

The film to be examined is held in position by means of a ball type film holder mounted in a clear "Perspex" bar which enables the top edge of the film to be seen. The narrow back to front measurement of 4½in is an asset for surface or recessed wall mounting. When heavier densities up to 2·5 are to be examined, the illuminator can be fitted internally with a high-intensity photoflood lamp. A dimming device can also be supplied.

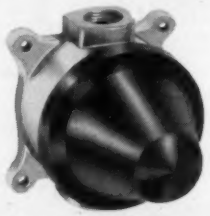


Newton Victor "Maxilume" radiograph illuminator

To avoid risk of damaging the wet film by accidental contact with the illuminator and to prevent water entering the illuminator itself, a one-piece plastics panel can be supplied with the lower end of the panel moulded to form a channel to catch drips from the wet films. Illuminators and accessories are available from stock for operation from 200 to 250 V 40 to 60 c/s. The standard unit costs £13 and with a dimming device £15 15s.

Waterproof Time-lag Switch

In response to a demand for a waterproof time-lag switch for outside installation, a flexible rubber shroud has been devised for fitting over the standard model 110 "Columbus" time-lag switch manufactured by the ELKAY ELECTRICAL MANUFACTURING CO., LTD., 42, Woburn Place, London, W.C.1. The plunger of the switch is pressed through a flexible rubber cover which immediately returns to its original position, allowing the plunger to gradually return over the period of the time-lag (1 sec up to 5 min). The rubber shroud is priced at 5s 4d and a complete unit comprising a switch, waterproof shroud and cast alloy box for surface mounting is £1 12s 4d.



"Columbus" waterproof time-lag switch (Elkay Electrical Manufacturing Co.)

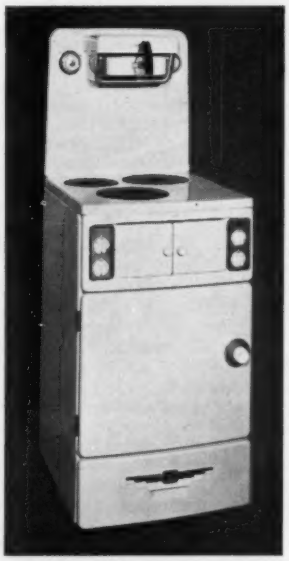
Cooker with Eye-Level Grill

An interesting development of their No. 394 cooker is being introduced by the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1. In effect it is the removal of the grill from the hob-plate to the splash-plate, bringing it to eye level. First it may be said that the oven is the same except that the grid shelves are given a bright plated finish to enable them to be more easily cleaned and retain their appearance. A new handle has been fitted to the oven door; this is in white with a bright trim and is smaller in diameter and projection.

The transference of the grill has brought about changes in the hot-cupboard arrangements. Instead of the drop-down door two side hinged double-cased doors with neat circular knobs are provided. On each side of these is a pair of control switches mounted on gold-anodised aluminium plates.

Taking the place of the top-plate of the former grill is a third (8in dia.) "Speedring" boiling plate controlled by a six-heat switch. This is conveniently placed for vessels which call for constant attention. To compensate for the loss of the grill top plate for making drop scones the company has provided a flat circular plate, with handle, for placing on one of the boiling plates.

At first sight, the grill in its new position appears to be smaller than it actually is; it is, however, no smaller than the E.D.A. standard. The pan has a small projection because it actually goes through the splash plate into a cavity at the back. This housing does not mean that the cooker takes more space forward, because the back projection is no more than is ordinarily required for the cable connection. The back of the cooker is designed to slope away from the wall towards the base.



The Jackson "Joy" cooker with eye-level grill

This permits an air flow round the rear of the grill chamber to deflect fumes from the wall and also to keep down the temperature of the oven-timer control and grill switch mounted on the front of the grill chamber.

The 2 kW grill element is mounted on a metallised casting which presents a downward reflecting surface, minimising loss of heat through the top. However, the top has formed ridges upon which plates can be placed for warming. By selecting the grill runners and altering the position of the grid in the pan six grilling positions are obtainable. The grill unit is designed to be easily removed from the front for maintenance purposes.

This new design (the "Joy," Cat. No. 396) will become available towards the end of March and will be on view at the Ideal Home Exhibition. It is available with white or cream finish.

Financial Section

STOCKS and SHARES

SINCE the House of Commons debate on the Government's economic policy, the Stock Exchange has seen a confirmation of the investment trend in favour of Government stocks and other fixed-interest securities, rather than industrial ordinary shares. The course of prices in the two markets diverged a little further upon the removal of any doubt about the Government's determination to sustain the credit squeeze with all the rigour necessary to deal with inflation. While a further improvement in the value of the pound helped the gilt-edged market, the outlook for the industrial section remained lacking in inspiration: business there has been bordering at times upon stagnation, relieved by points of interest in new issues or individual company news. As a market factor, " ZETA " does not yet appear to have made an impact.

Price Changes

With other Government securities, the British Electricity stocks again made advances of up to a full point during the week. They now stand some 3 to 5 points clear of the nadir reached towards the end of last year. Electrical ordinary shares again behaved more steadily than many other industrials. A.E.I. and English Electric, with the announcements of the 1957 results approaching, picked up the small losses of the previous week. Reyrolle recovered half-a-crown to 82s 6d, and Westinghouse Brake improved further to 33s 9d under the influence of the good annual results reported earlier. On the other hand, Plessey remained dull at 55s, and lower prices ruled for Desoutter, Chloride Electrical, Laurence Scott, Tube Investments and a few others. E.M.I. were again well supported at over 30s.

Babcock & Wilcox Issues

Some £3,800,000 new capital is being raised by Babcock & Wilcox to assist in financing the group's new projects and an expanding turnover. Part of the money is to come from the offer of £2 million 6 per cent debenture stock, at 97, to all classes of stockholders: the application lists close on 11th February. For the balance, ordinary stockholders are offered 1,881,000 new £1 ordinary shares at a price of 20s. In early dealings, these changed hands at a premium of about 23s 3d, which improved later to 24s 3d. In their circular to stockholders, the directors said they did not expect significant benefits from the new expenditure in the immediate future, and taking into account the present trend of profit margins they foresaw the possibility of a period of somewhat lower earnings.

Dividend Forecast

Babcock & Wilcox profits for the year just ended are estimated by the directors to have been at about the

Price Changes in

Company or Board	Nom. Value	Middle price 27th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	73		3	3	4 2 3	80	70
Brit. Elec. 1974/77	100	70½	+½	3	3	4 5 0	78½	66
Brit. Elec. 1976/79	100	73½	+½	3½	3½	4 15 3	81½	70
Brit. Elec. 1974/79	100	85½	+1	4½	4½	4 19 6	92½	79½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-		6†	6·8†	8 10 0†	19/-	15/-
East African Power	£1	18/6		7	7½	8 2 3	21/-	19/-
Nigerian Elec.	£1	16/6		10	10	12 2 6	18/6	16/6
Perak Hydro-Elec.	£1	15/-		10	12½	16 13 3	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	10/6		17½	17½	8 6 9	12/-	9/9
Aerialite	1/-	5/9		48	51½	8 19 3	6/9	4/9
Allen, W. H.	£1	34/6		10	10	5 16 0	47/3	33/6
Anglo-Portuguese Tel.	£1	21/3		8	8	7 10 6	27/6	20/6
Aron Elec. Ord.	£1	54/-		15	15	5 11 0	60/-	53/6
Assoc. Elec. Ord.	£1	48/9	+1/3	15	15	6 3 0	73/-	48/9
Automatic Tel. & El.	£1	60/-		15	17	5 13 3	75/-	54/6
Babcock & Wilcox	£1	43/9x.r.		15	13‡	5 18 9	82/6	54/9
Bakelite	10/-	20/-		16	15	7 10 0	24/6	20/9
Baldwin, H. J.	2/-	3/6		20	20	11 8 6	5/-	3/9
Berry's Electric	5/-	6/-		—	10	8 6 9	6/6	5/6
British Aluminium	£1	43/9	+9d	12	12	5 9 6	71/3	38/9
Brit. Elec. Traction: Def. Ord. " A "	5/-	22/-	+6d	22½	25	5 13 9	25/-	17/-
B.I. Callender's	£1	41/3	+1/-	12½	12½	6 1 3	55/-	39/6
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	21/9	19/-
British Tabulating	£1	40/-		9	10	5 0 0	56/3	37/6
British Thermostat	5/-	20/-		25	25	6 5 0	27/6	21/3
British Vac. Cleaner	5/-	5/-		15	10	10 0 0	8/-	5/-
Brook Motors	10/-	33/9		25	25	7 8 3	37/6	30/-
Bulgin, A. F.	1/-	4/9		50	40*	8 8 6	5/6	4/-
Burco Dean	5/-	13/6	−6d	20	22½	8 6 9	14/-	8/9
Cable & Wireless: Ord.	5/-	9/6		10	10	5 5 3	12/6	9/6
4% Loan	100	93	+1	4	4	4 6 0	92½	89
Chloride El. Storage " A " ...	£1	56/3	−6d	17½	17½	6 4 6	68/9	55/9
Clarke Chapman	£1	145/-		22½	27½	3 15 9	9	5½
Cole, E. K.	5/-	16/6	−6d	17½	17½	5 6 0	23/6	16/6
Cossor, A. C.	5/-	5/-		Nil	2½	2 10 0	7/3	5/-
Crabtree	10/-	24/9		20	20	8 1 6	26/-	23/3
Crompton Parkinson Ord. ...	5/-	9/-		16	16	5 18 6*	11/9	9/3
De La Rue	5/-	23/3	+9d	30	35	7 10 6	24/9	16/3
Decca " A "	4/-	23/3		43½	43½	7 10 6	32/3	22/-
Desoutter	5/-	14/-	−1/6	30	32½	5 16 0*	17/9	13/9
Dewhurst	2/-	7/6		16½	20	5 6 9	7/9	5/9
Dictograph Tel.	2/-	5/3		20	20*	7 12 6	6/3	5/3
Dubilier Condenser	1/-	3/3		30	30	—	5/3	3/-
Duport	5/-	8/6		25	25	7 7 0*	10/6	8/6
E.M.I.	10/-	30/3	+6d	15	15	4 19 3	36/-	23/9
Electrical Components	5/-	7/6		25	12½*	8 6 9	8/-	6/6
Elec. Construction	£1	22/6		8½	8½	7 11 0	27/6	21/9
Elliott-Automation	5/-	11/9		—	10‡	4 5 0	12/6	10/3
Enfield Cable Ord.	£1	12/-	−9d	Nil	Nil	Nil	21/6	12/3
English Electric	£1	47/6	+1/3	12½	14	5 18 0	65/-	47/6
English Electric 3½% Pref. ...	£1	12/3		3½	3½	6 2 6	14/3	11/3
Ericsson Tel.	5/-	18/9	+3d	20†	22†	2 18 9*†	25/-	17/-
Ever Ready	5/-	14/6		35	37½	6 9 3*	20/-	14/-
Falk Stadelmann	£1	36/3		17½	17½	9 13 0	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

level of 1956, for which year there was a dividend of 15 per cent, paid from earnings equivalent to 50 per cent on the ordinary capital of £7·5 million. On capital increased by the new issue, the intention is to distribute a final dividend of 6¾ per cent in June, making a total equivalent to approximately 13 per cent and to pay that rate (in the absence of unforeseen events) for the current year. Assuming the realisation of this dividend forecast, the new shares at an all-in price of 44s 3d offer a prospective yield of £5 17s 6d per cent. Payment for the shares is due in full by 11th February. For the present they are transferable free of stamp duty.

Electrical Investments

Company or Board	Nom. Value	Middle price 27th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Electrical Shares—continued						£ s d		
G.E.C. Ord.	£1	37/6		14	12½	6 13 3	58/9	37/6
G.E.C. 6½% Pref.	£1	21/-	+6d	6½	6½	6 3 9	23/6	19/6
General Cables	5/-	12/-		30	24	10 0 0	15/6	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	51/3	45/3
Hackbridge Holdings	5/-	9/3	−6d	30	20	10 16 3	21/9	11/3
Hackbridge & Hewittic	5/-	11/3		23	20	8 17 9	16/-	10/-
Head Wrightson	5/-	18/9		20	22½	—	24/3	16/6
Heatrae	2/-	4/6	−3d	15	15	6 13 3	4/9	4/-
Henley's	10/-	11/6		11½	11½	10 0 0	17/-	11/-
Holophane	5/-	13/3		30	37½	8 9 9*	15/9	10/3
Hoover	5/-	32/6		50	50	7 13 9	44/-	24/9
I.C.I.	£1	38/3	−3d	10	10	5 4 6	46/6	36/3
Intl. Combustion	5/-	20/6		20	22½	5 9 9	30/-	19/3
Johnson & Phillips	£1	17/6		15	10	11 8 6	34/6	18/9
Lancashire Dynamo	£1	32/6		11	11	6 15 3	45/9	33/6
Laurence, Scott	5/-	13/9	−6d	15	15	5 9 0	19/9	13/9
Lister, R. A.	£1	25/9		10	10	7 15 3	33/9	23/3
London Elec. Wire	£1	41/3	+6d	12½	12½	6 1 3	53/9	40/9
Lucas, J.	£1	28/-		7½	7½	5 7 3	36/6	27/6
Marconi Marine	£1	30/-		10	10	6 13 3	37/-	30/-
Marryat & Scott	2/-	10/6		30	35	6 13 3	13/-	8/-
Mather & Platt	£1	47/-		15	15	6 7 9	63/9	47/-
Metal Industries	£1	25/6		Nil	9	7 1 3	30/-	20/3
Midland Elec. Mfg.	£1	47/6		12½	12½	5 5 3	52/6	45/-
Morphy-Richards	4/-	15/-		50	20*	5 6 9	20/-	11/6
Murex	£1	55/9	−1/-	20	20	7 3 6	79/6	58/3
Newman Ind.	2/-	2/9		10	10	7 5 6	2/11	2/1
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parnall (Yate)	5/-	6/-	−3d	12	12	10 0 0	8/9	5/9
Parsons, C. A.	£1	50/-		8½	7½*‡	—	71/3	45/-
Plessey	10/-	55/-	−1/3	30	30	5 9 0	86/3	60/-
Pye "A" Deferred	5/-	12/-		12½	12½	5 4 3	20/-	12/-
Reyrolle	£1	82/6	+2/6	16½	17½	4 4 9	110/-	72/-
Rheostatic	4/-	7/9		18½	12½*	6 9 0	10/-	7/-
Richardsons Westgarth	10/-	14/-	+3d	16½	16½	5 19 0*	20/-	13/6
Scottish Cables	4/-	12/9	−6d	27½	27½	8 12 6	19/3	13/3
Simon-Carves	5/-	24/3		28½	20*	4 2 6	36/3	23/9
Smith (England), S.	4/-	7/6		17½	20	5 6 9*	8/-	6/3
Southern Areas	£1	11/3		7½	7½	13 16 9	20/-	11/3
Strand Elec.	5/-	5/9		15	15	13 0 9	8/-	5/9
Sturtevant	5/-	17/9		15†	15†	4 4 6†	27/-	17/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	42/-
Switchgear & Cowans	5/-	9/3		25	25	13 10 6	15/6	9/6
Taylor Tunnicliff	5/-	11/9		15	15	6 7 9	13/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	41/3	35/-
T.C. & M.	£1	21/6		8½	8½	7 18 3	31/-	23/6
Telephone Mfg.	5/-	5/3		10	10	9 10 6	8/-	5/3
Telephone Rentals	5/-	10/3	+3d	12½	12½	6 2 0	12/6	9/6
Thompson (John)	5/-	24/-	−6d	25	25	5 4 3	37/-	23/6
Thorn Elec.	5/-	20/9		15	17½	4 4 3	26/3	16/3
Thornycroft	£1	26/6		12½	12½	9 8 9	37/6	21/3
Tube Investments	£1	51/3	−1/3	13½	15	5 17 0	70/-	51/3
Vactric	5/-	14/6		17½	25	8 12 6	23/9	12/9
Veritys	5/-	5/3	−1/6	12½	12½	11 18 3	9/3	6/9
Walsall Conduits	4/-	11/9		20	20	6 16 3	15/-	11/-
Ward & Goldstone	5/-	25/-		35	40	4 0 0*	29/-	18/6
Watford	2/-	6/-		25	25	8 6 9	6/9	5/9
Westinghouse	£1	33/9	+9d	18	10*	5 18 6	41/3	28/9
West, Allen	5/-	9/9		15	15	—	13/6	9/6
Wolf Electric	5/-	9/-		20	20	5 11 0*	13/9	8/9

Permali Yield

A moderate number of Permali 2s ordinary shares has lately been in the market at a price of 2s 10½d, offering a yield of nearly 9½ per cent on the basis of the 13½ per cent dividend paid for 1956–57. Maintenance of this rate for the current year was forecast by the company (with the usual reservations) last August, when fresh capital was raised by the issue of about a million new shares at 3s 6d each. This was done in connection with expenses involved in centralising the group's production facilities at Gloucester, and in other developments. An interim dividend on account of the year ending in March is due to be declared in that month. Capital of the company is now £504,000, all in ordinary shares. There is also in issue £300,000 6 per cent convertible loan stock.

Rhodesian Cables

Although not officially quoted in the London Stock Exchange, dealings are allowed under a special rule in the 1s 6d shares of Rhodesian Cables in which British Insulated Callender's Cables are substantially interested. The Rhodesian company has lately raised about £325,000, to finance an extension of its facilities, through an issue of 3 million new shares. Of these, 2 million were to be taken up at 2s 3d by B.I.C.C., who already held 36 per cent of the original £225,000 capital, and the remaining million were offered to all ordinary shareholders at 2s per share. These have been quoted recently at about the issue price. For 1956–57 a first dividend of 1d per share has been paid on the older capital. At the time of the issue no forecast was made of profits or dividends in the current year, but it was stated that a satisfactory return could be expected from the developments for which the new capital is being raised.

Debentures and Loans

The issue of a new Babcock & Wilcox 6 per cent debenture at 97 has been announced at a time of substantial demand for stocks of this character. Among company prior charges already in the market, the Vickers 6 per cent loan stock 1977/80 has been offered lately at about 98½, and can still be bought free of transfer stamp duty. The G.E.C. issue of the same description, and redeemable 1976/81, now stands only a fraction under 100. On this company's 4 per cent loan 1975/80 at 74, and on the English Electric 4 per cent debenture 1965/85 at 74½, the current yields are not quite 5½ per cent, but in these cases there are substantial capital profits in prospect upon their eventual repayment at 100.

REPORTS and DIVIDENDS

Brook Motors, Ltd.—The annual meeting was held on 25th January, Mr. F. V. Brook (chairman and joint managing director) presiding. In his circulated statement, Mr. Brook said that the improved position shown in the half-yearly report had continued throughout the remainder of the financial year under review, increased labour costs being partially offset by reductions in certain material prices, and to a larger extent through internal production method changes. The turnover was a further record. Their direct exports showed improvement despite restriction difficulties and keen competition in some countries. Additionally the American company expanded at a satisfactory rate.

The new factory for the manufacture of f.h.p. motors was now completed and full production should be attained early in 1958. A further recent standardisation in the electric motor field had culminated in the introduction of a new design ventilated motor which would also meet the needs of the North American continent. Other models were being designed to the same style which should increase their opportunities for sales to both home and export customers.

The Westinghouse Brake & Signal Co., Ltd.—The report and accounts for the year ended 28th September last, now issued, confirm the figures given in our issue of 17th January.

In his accompanying statement, Mr. A. R. S. Nutting (chairman) says that orders received were greatly in excess of the previous year's record, and despatches reached an exceptionally large total. They met with considerable success in competing on the basis of price, delivery dates, and technical excellence for large contracts abroad.

The demands of the home market for signalling improved materially; developments in semi-conductors cause increased expenditure and intensification of research and development, and deliveries of brakes for the home and overseas markets attained record figures.

The modernisation and re-equipment plans of the British Transport Commission, while they have not materially affected the group's position during 1956-57, will, so far as vacuum brakes and signalling are concerned, create a substantially greater home demand during 1958 and thereafter. The improvements in the results of the subsidiaries in Australia, India and South Africa have been a major factor in the good trading results of the year under review. Another important factor is the turning of a substantial loss by Douglas (Kingswood), Ltd., into a trading profit.

Dealing with the various divisions, Mr. Nutting says that the despatched sales of the Brake Division have attained a record. In the signalling and colliery division the year has been the best in the history of the company so far as production and orders are concerned. They have received the first orders from British Railways for their "Westronic" remote control equipment, incorporating the latest electronic devices.

The rectifier division attained another record output. Last year they added the germanium type rectifier to their range and this unit is already heavily committed. For some years their research has been directed towards the production of a rectifier employing silicon, which opens up the possibility of rectifier applications in many new fields, such as electric traction, electrolytic plants, and many industrial applications beyond the capabilities of copper oxide, selenium or germanium.

In research and development, the introduction of 50 c/s traction in this country has necessitated their development of new equipment for track circuits, special instruments for detection and measurement of stray traction current in signal circuits, and a new form of track circuit using a high frequency with transistor equipment. After reviewing the progress of the subsidiary companies of the group, Mr. Nutting says that the current year promises well, as orders on hand of the parent company and its subsidiaries (a high proportion from overseas) ensure a very busy year.

T. Beadle & Co., Ltd., wholesale distributors of electrical and radio accessories, motor car and garage equipment and machine tools, etc., are making an issue of 70,000 £1 "B" ordinary shares at par. The issue, the subscription list for which opened on Tuesday last, is open to the general public, but preferential consideration is being given to "B" ordinary shareholders, customers and suppliers. If taken up and fully paid by 28th February, the new shares will have the right to share in profits available for distribution for the year ending 28th February next. The capital issued and to be issued consists of 12,000 "A" ordinary shares of £1 each and 237,812 "B" ordinary shares of £1 each.

The Gas Purification & Chemical Co., Ltd.—During the course of his statement which has been issued with the report and accounts for the year to 30th June last, Mr. J. R. Sorbie (chairman and managing director) refers to the acquisition of A.B. Metal Products, Ltd., manufacturers of electronic components, and the formation, in agreement with the Amphenol Electronics Corporation of Chicago, of Amphenol (Great Britain), Ltd., which will offer the entire Amphenol range of electronic components, including connectors, high-frequency connectors, cable and cable assemblies, plugs and sockets, in the British Commonwealth (apart from Canada) and in Europe. While importing certain components from America in the first instance, it will gradually proceed towards 100 per cent manufacture of those articles considered particularly suitable for this market.

Marco Refrigerators, Ltd.—The annual meeting will be held on 19th February. In his circulated statement, Mr. E. G. Batt (chairman) says that the main item of expenditure during the year under review has been the erection and equipment of a new test and development laboratory. The building has been erected at the rear of the Rowan Road factory and contains a modern soundproof room which will enable the company to extend its research and testing activities on new designs. Competition both in the home and overseas markets has continued to increase during the year, but in spite of import restrictions in a number of overseas markets the value of sales substantially increased. During the year two new ranges of frozen food display cabinets, the "Marview" and the "Marquis," were introduced, both of which are selling well. Demand for the remainder of the company's products has continued to be uniformly high. Increased efficiency and production has enabled price increases of raw materials, wages, etc., to be absorbed while maintaining selling prices.

Liquidations

Savoy Radio, Ltd. (in creditors' voluntary liquidation).—Particulars of claims to the liquidator, Mr. N. W. Osborne, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1, by 6th February.

Ryhope Radio & Television Co., Ltd. (in creditors' voluntary liquidation).—Particulars of claims by 6th February to the liquidator, Mr. N. W. Osborne, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1.

H. G. Cockram, Ltd., electrical contractors, 38a, Park Road, Cheriton, Folkestone.—Last day for receiving proofs for dividend 6th February. Liquidator, Mr. N. W. Osborne, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1.

Bankruptcies

S. L. Blythe, G. N. Bryan and **D. Mosley,** formerly trading together under the style of Kirkstall Radio & Electrical Service at Kirkstall Lodge, Edwinstowe, Notts, radio and electrical engineers. (Separate application of S. L. Blythe).—Application for discharge to be heard on 14th February at the Court House, St. Peter's Gate, Nottingham.

C. Sykes, 10, High Keppleway, Broughton-in-Furness, Lancs, electrician.—Supplemental dividend of 6½d in the £, payable at the office of the Official Receiver, 14, Lowther Street, Carlisle.

L. G. Brown, lately carrying on business at 31a, Colin Road, Luton, dealer in household and electrical equipment.—First meeting today (Friday) at the County Court Office, 38, Upper George Street, Luton. Public examination 6th March at the Court House, Stuart Street, Luton.

K. Hanson, trading as Hanson's Electronics at 2, Hall Street, Burnley, and 1, Parker Lane, Burnley, Lancs, electrical engineer.—Last day for receiving proofs for dividend 10th February. Trustee, Mr. L. H. Shipton, 31, Lloyd Street, Manchester, 2.

GENERATION AND DEVELOPMENT

Supply Improvement in Bath Area

The South Western Electricity Board has approved a construction project costing just over £24,500 to reinforce and improve power supplies in the Larkhall, Lower Swainswick and Bailbrook areas of Bath.

Announcing this on 23rd January, Mr. R. W. Steel, the Board's manager for the Bath District, said that the scheme would give still greater security and reliability of supply to consumers. The low-voltage single-phase supply in the area would be largely replaced by a modern three-phase system operating at the national standard voltage.

Compensation to Scottish Landowner

In order to counter what it described as "erroneous reports," the North of Scotland Hydro-Electric Board announced last week that the amount of compensation paid to Lord Lovat for damage to his land and fishing interests caused by the Strathfarrar scheme was £100,000. The scheme would involve the flooding of 650 acres of marginal land and interference with some 18 miles of fishing. In assessing the compensation the Board had the advice of independent land and fishery experts and the amount actually agreed upon was less than they had recommended.

Voltage Confusion

The Midlands Electricity Consultative Council is to ask the Board to indicate in some way the voltage of supplies to consumers' premises.

Discussing the troubles some people had encountered, Mr. F. G. Wynne said that there were 106,000 consumers in the area who were still not on the standard 240 V supply, nor even on the old standard 230 V. Consequently when they bought electrical fittings and appliances there were frequent complaints that they were inefficient simply because the voltage to the consumers' premises was not sufficient to make them function effectively. He suggested that the Board should attach a label to each meter stating the voltage.

Wilful Damage to Overhead Lines

Wanton or wilful damage to the South Eastern Electricity Board's overhead electric lines is causing such concern that the Board proposes to take proceedings against all future offenders. A reward of £5 is offered for information leading to a conviction. Mr. Norman Elliott, the Board's chairman, says that this decision has been taken reluctantly. Experience suggests that children and youths are mainly responsible.

The value of annual damage is estimated at several thousands of pounds. Damage to insulators often involves breakdown of supply; one incident temporarily deprived an important industrial establishment of supply and another resulted in several villages being "blacked-out." Removal or defacement of pole-identification plates could have serious consequences both for the culprits and for Seeboard employees. Among other causes of breakdown of supply and damage have been chains or wires thrown across overhead lines and metal-strutted kites becoming lodged in the conductors.

Rosyth Reinforcement

The South of Scotland Electricity Board announced on 22nd January approval of a scheme to reinforce supplies to Rosyth at an estimated cost of £67,400. The high voltage system in Rosyth will be reinforced from 6·6 to 11 kV. The low voltage cables and services will also be reinforced. In addition, a new 33 kV substation will be established at Inverkeithing. The work will be completed next year.

Scottish Generating Plant in 1957

In the following schedules is embodied information relating to the new plant commissioned by the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board during last year. Schedules for England and Wales were published in our 10th January issue.

SOUTH OF SCOTLAND ELECTRICITY BOARD

Station	Turbo-Alternators		Boiler Plant		Main H.P. Pipework
	Installed Capacity MW	Makers	Capacity k.lb./hr	Makers	Makers
Barony	1×30	General Electric Co.	2×150	Babcock & Wilcox, Ltd.	Babcock & Wilcox, Ltd.
Dalmarnock	1×60	C. A. Parsons	3×200	Yarrow	Stewarts & Lloyds

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Station	Turbo-Alternators	
	Installed Capacity MW	Makers
Hydro Installations Cluanie Dam*	1×0·30	Turbine by Armfield Hydraulic Co.; alternator by Bruce Peebles
Invergarry Dam*	1×0·32	Turbine by Armfield Hydraulic Co.; alternator by Bruce Peebles
Meig Dam*	1×0·07	Turbine by Armfield Hydraulic Co.; alternator by Bruce Peebles
Quoich Dam*	1×0·35	Turbine by Gilbert, Gilkes & Gordon; alternator by Bruce Peebles
Mossford*	2×12	Turbines by Harland Engineering; alternators by Bruce Peebles
Sron Mor*	1×5	Turbine and alternator by English Electric Co.
St. Fillans*	1×21	Turbine by Harland Engineering; alternator by Bruce Peebles
Glenmoriston*	1×16	Turbine and alternator by English Electric Co.
Diesel Installations Kirkwall	1×2	Diesel set by Mirrlees, Bickerton & Day
Lerwick	1×2	Diesel set by Mirrlees, Bickerton & Day
Steam Installation Dundee	1×30	Turbine by English Electric Co.; boilers 2×150,000 lb/hr by John Brown (Land Boilers), Ltd.

* Stations in which plant was commissioned for the first time in 1957.

OVERSEAS

Large Loan for Brazil

The World Bank has sanctioned a loan of $13·4 million to the Usinas Electricas do Paranapanema, in the State of Sao Paulo, Brazil, to assist in the financing of an 85 MW hydro-electric plant at Jurumirim, on the Paranapanema River. The total cost of the scheme is put at $47·5 million. Altogether ten loans have been made to Brazil by the World Bank and of the total of $182·5 million $154·5 million has been in respect of electric power projects.

Colombo Tramway Service Discontinued

The last tram services in Colombo are to be abandoned this month. Some routes have already been replaced by trolley-buses. The municipality has been losing several million rupees every year on the tram services.

NEW PATENTS — Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 5th February from the Patent Office, 25, Southampton Buildings, London, W.C.2

1946

4827. Standard Telephones & Cables, Ltd.—Phase comparison radio direction finding systems. 15th February, 1946. (Cognate application 4828, 19th February, 1945.) (790360.)

1953

34932. Gardner, J. G.—Magazine primary electrical cell depolarising apparatus. 15th March, 1955. (790299.)

1954

6330. Heron, A. G.—Electrical defrosting means for use with refrigeration apparatus. 3rd March, 1955. (Cognate application 18257, 22nd June, 1954.) (790111.)

7636. British Thomson-Houston Co., Ltd.—Negative temperature coefficient resistors. 20th May, 1955. (790363.)

13909. Soc. Nouville de l'Outillage R.B.V. et de la Radio-Industrie.—Television cameras. 12th May, 1954. (790208.)

20869. Siemens-Schuckertwerke Akt.-Ges.—Process for the production of selenium of high conductance. 16th July, 1954. (790213.)

22187. General Electric Co., Ltd.—Wire composed of nickel base alloy. 31st October, 1955. (790303.)

29936. Manning, Maxwell & Moore, Inc. —Automatic electrical process-control systems. 18th October, 1954. (790368.)

31332. Murphy Radio, Ltd.—Variable reactance circuit elements and applications thereof. 27th October, 1955. (790219.)

36301. Pye, Ltd.—Television receivers. 16th December, 1955. (790225.)

1955

1745. Igranic Electric Co., Ltd.—Electromagnetic switch operating mechanism. 20th January, 1955. (790371.)

2551. Telefonaktiebolaget L. M. Ericsson.—Fault localising apparatus. 27th January, 1955. (790313.)

3694. Standard-Thomson Corporation.—Thermal responsive valve. 8th February, 1955. (790054.)

5496. Koehler Manufacturing Co.—Separators for storage batteries and method of making same. 23rd February, 1955. (790315.)

5588. General Electric Co., Ltd.—Electrical rectifying circuit arrangements. 23rd February, 1956. (790123.)

7115. English Electric Co., Ltd.—Magnetic recording and reproducing systems. 8th March, 1956. (790230.)

9671. Cole, Ltd., E. K., and Davis, R. G. —Containers for radioactive materials. 3rd April, 1956. (790319.)

11231. Telecommunication Instruments, Ltd.—Subaqueous sound-transmitting apparatus. 5th March, 1956. (790235.)

11403. Fletcher, W. H.—Multi-unit independently operated electric switches. 20th July, 1956. (790127.)

11577. British Thomson-Houston Co., Ltd.—Control systems for electric motors. 20th April, 1956. (790376.)

14328. Simon-Carves, Ltd.—Electrostatic precipitators. 16th May, 1956. (790130.)

14981. British Thomson-Houston Co., Ltd.—Glass-to-metal seals. 11th May, 1956. (790061.)

15621. Radio Heaters, Ltd.—Radio frequency dielectric heating equipment. 15th June, 1956. (790242.)

15702. International Business Machines Corporation.—Electrical checking circuit. 1st June, 1955. (790323.)

16566. Midland Electric Manufacturing Co., Ltd.—Electric fuses. 5th June, 1956. (790324.)

17087. Marconi's Wireless Telegraph Co., Ltd.—Mountings for electron-discharge tubes. 19th March, 1956. (790065.)

17575. Chromatic Television Laboratories, Inc.—Methods of welding wires to a holder. 17th June, 1955. (790325.)

17747. Telefunken Ges.—Synchronising circuit arrangements especially for the line synchronisation of television receivers. 20th June, 1955. (790379.)

18163. Lucas (Industries), Ltd., J.—Brush or other contact holders for dynamo-electric machines and other electrical apparatus. 12th June, 1956. (790247.)

19848. Westinghouse Air Brake Co.—Combined manual and automatic route control system for railroads. 8th July, 1955. (790249.)

23044. Ransburg, H. J., Ransburg, H. G., Ransburg, H. P., and Ransburg, E. M. (trading as Ransburg Co., H. J.).—Electrostatic methods and apparatus. 10th August, 1955. (790381.)

23338. Varian Associates.—High frequency reflex klystron tube. 12th August, 1955. (790142.)

23464. Bendix Aviation Corporation.—Variable-rate pulse counting circuits. 15th August, 1955. (790143.)

23818. General Motors Corporation.—Tuner devices for radio frequency amplifier apparatus. 18th August, 1955. (790383.)

24241. General Electric Co.—Radiant energy systems. 23rd August, 1955. (790384.)

26387. Square D Co.—Electric control circuits. 15th September, 1955. (790257.)

27876. Contactum, Ltd.—Electric fusible cut-out devices. 8th August, 1956. (790331.)

28786. Western Electric Co., Inc.—Circuit arrangements utilising semi-conductive devices and methods for making such devices. 10th October, 1955. (790387.)

29439. United Kingdom Atomic Energy Authority.—Fuel elements for use in nuclear reactors. 9th October, 1956. (790389.)

29479. General Motors Corporation.—Electric measuring circuit arrangement. 17th October, 1955. (790148.)

30782. General Electric Co.—Electric pump-motor assemblies. 27th October, 1955. (790333.)

32074. Sylvania Electric Products, Inc.—Image-producing viewing devices. 9th November, 1955. (790153.)

32799. Soc. Anon. pour les Applications de l'Electricité et des Gàz Rares-Etablissements Claude-Paz & Silva.—Method of manufacturing an electron emissive electrode. 16th November, 1955. (790154.)

36731. General Electric Co.—Protective systems for a.c. machines. 22nd December, 1955. (790336.)

36940. Siemens & Halske Akt.-Ges.—Cold-cathode gas-filled or vapour-filled electron discharge tubes. 23rd December, 1955. (790157.)

1956

438. Philips Electrical Industries, Ltd.—Control members. 5th January, 1956. (790390.)

1979. Marconi's Wireless Telegraph Co., Ltd.—Television apparatus. 7th September, 1956. (790338.)

7431. Forges et Ateliers de Constructions Electriques de Jeumont.—Electrical isolating switches. 9th March, 1956. (790395.)

7737. Siemens-Reiniger-Werke Akt.-Ges. —Apparatus for electric high-frequency surgery. 12th March, 1956. (790396.)

8019. Penney, G. W.—Electrostatic precipitators. 14th March, 1956. (790274.)

12958. Etablissements E. Jaeger.—Electromagnetic torque transmission devices. 27th April, 1956. (790097.)

13855. Western Electric Co., Inc.—Image transmission systems. 4th May, 1956. (790180.)

14008. Square D Co.—Electromagnetic switches. 7th May, 1956. (790099.)

19352. Bosch Ges., R.—Apparatus for manufacturing electrical condensers. 22nd June, 1956. (790186.)

CATALOGUES AND LISTS

BOILER CONTROL.—Brochure describing a two-element boiler feed regulator for controlling the feed make-up in water-tube boilers.—**G. & J. Weir, Ltd.**, Cathcart, Glasgow, S.4.

CONCRETE.—32-page booklet dealing with the properties and applications of "Ciment Fondu" and describing the use of the cement for producing corrosion-resistant concrete, refractory concrete and heat insulating concrete for such uses as power station furnace foundations and bases, stacks and chimneys, flues and ducts, boilers, etc.—**Lafarge Aluminous Cement Co., Ltd.**, 73, Brook Street, London, W.1.

FLUORESCENT LAMPS. — Leaflet giving particulars of the company's 8ft 125 W fluorescent lamps fitted with R.D.C. (recessed double contact) caps which have been specially designed for use with these tubes to provide a firm, reliable location in the fitting without the need for independent clips.—**General Electric Co., Ltd.**, Magnet House, Kingsway, London, W.C.2.

Folder giving facts and figures on the company's "Double Life" fluorescent tubes. —**Atlas Lighting, Ltd.**, 233, Shaftesbury Avenue, London, W.C.2.

INSTRUMENTS. — Illustrated brochure (993) dealing with the "Commander" KE high-speed electronic instruments.—**George Kent, Ltd.**, Luton, Beds.

LIGHTING FITTINGS. — Illustrated folder dealing with a new range of wrought iron products including floor standard and table lighting fittings.—**Essex Partners, Ltd.**, 67, Bridgewater Street, Liverpool, 1.

Leaflet (FC2) and a separate data sheet covering the "Morlite" range of fluorescent lighting fittings and a leaflet describing the QK5 slim line 5ft batten fitting.—**Morley's Electrical Services (Holloway), Ltd.**, 117, Hornsey Road, London, N.7.

NUCLEAR POWER PLANT AUXILIARIES.—Brochure describing control valves and pumps for use with nuclear power plant. —**G. & J. Weir, Ltd.**, Cathcart, Glasgow, S.4.

PUMPS.—Illustrated brochure describing types UPL and UHL horizontal self-priming centrifugal pumps.—**British Labour Pump Co., Ltd.**, Blundell Street, London, N.7.

SIGNS.—40-page catalogue showing the range of warning, danger and other signs produced by the company.—**Bribond, Ltd.**, Burgess Hill, Sussex.

Wavey WASHERS

Beryllium Copper "Wavey" Washers. For Electronic Components. Range 8BA to ¼. Corrosion resisting, non-damaging to components, higher resistance of "set", higher recovery of load, permanent spring action. They are fabricated from Beryllium copper, heat treated to VPN.350 minimum, Electro Plated to DTD.924, Cadmium Plated to DTD.904 and Passivated to DTD.923. Samples and price lists on request.

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All rectifiers in Philips wide range are noted for:

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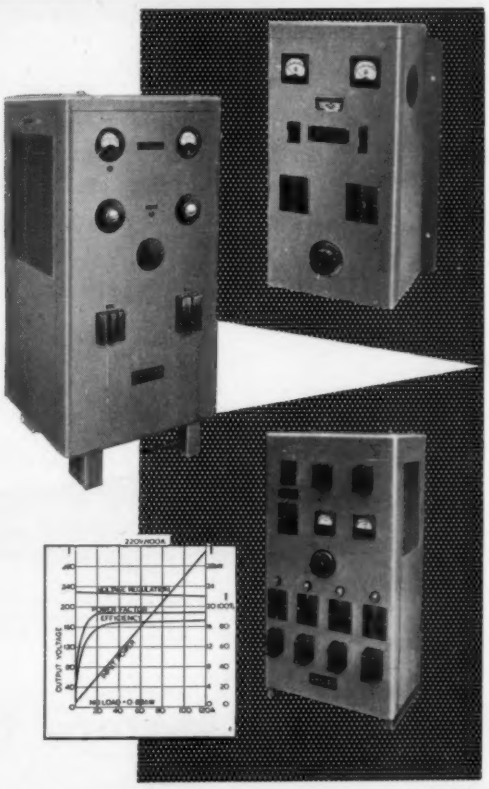
- *reliable service with minimum attention, due to absence of moving parts.*

General characteristics of a typical Philips Rectifier can be seen from the graph on right, showing a rectifier designed to operate from 3-phase supply and giving up to 100 amps at 220/230 volts DC.

The curves indicate:
(*a*) Excellent voltage regulation obtained from light load up to overload.
(*b*) Maintenance of high efficiency even at partial load.
(*c*) Small 'no load' loss.
(*d*) High power factor, well maintained at partial loads.

Rectifiers can be constructed to individual requirements or to fit into existing site conditions. If you would like our technicians to visit your premises and advise you without obligation, or if you require further details of our range of rectifiers, please write to address below.



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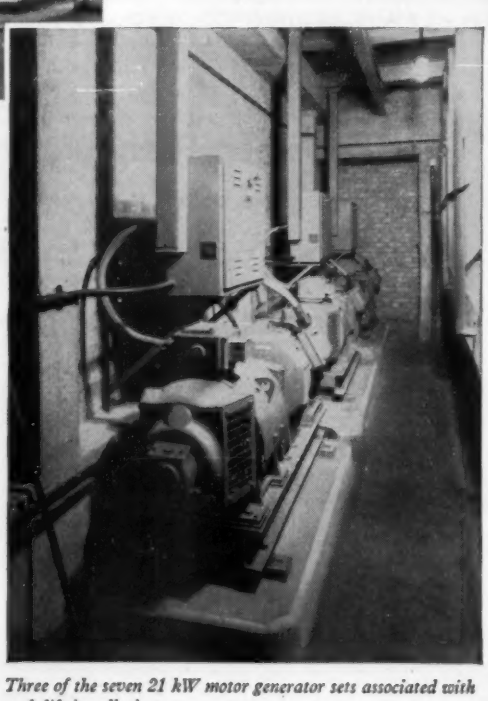
In co-operation with G. K. Jensen & Co. Ltd., Metrovick electronic control variable voltage lift drives are installed in Barrington House, Gresham Street, London.

Faster operation, more accurate levelling, with increased passenger comfort are among the advantages of this system. Acceleration and deceleration are controlled, and maximum speed is maintained constant irrespective of the direction of travel or load in the cage.



Three of the seven 21 kW motor generator sets associated with each lift installation.

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 3rd February

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. Discussion on "The Place of Liberal Studies in a Technical Institution," opened by E. H. Horrocks. (Combined meeting with Education Discussion Circle.)

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. Informal evening on "Domestic High-Fidelity Reproduction," by J. Moir.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "Current Trends in Heating and Ventilating Design and Practice," by L. N. Doe.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. 1957 Electrical Engineers Exhibition Film.

LONDON. — I.E.E. Education Discussion Circle, 6.15 p.m. Visit to Power Gallery of the Science Museum, South Kensington, S.W.7.

At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "Recent Developments in Line Transmission Systems," by R. H. Franklin and M. B. Williams.

White Hall Hotel, Bloomsbury Square, 6.30 p.m. A.S.E.E. Central London Branch. Brains Trust, "Women's Place in Electrical Industry."

Caxton Hall, S.W.1, 7 p.m. E.P.E.A. London Technical Group. "Cable Manufacture," by W. H. Lythgoe.

MAIDSTONE.—Maidstone Technical College, 7 p.m. I.E.E. district meeting. "A Criterion of Distribution Cost," by D. J. Bolton.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North Eastern Radio and Measurements Group. "Domestic High-Fidelity Reproduction," by J. Moir.

County Hotel, Neville Street, 6 for 6.30 p.m. North East Electrical Club. "Some Aspects of Light and Colour with particular reference to Display Lighting," by R. A. Chappell and B. O. Matthews.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. Sound films, by A. Aitchison.

STAFFORD.—Dunston Hall, near Stafford, 7.45 p.m. I.E.E. North Staffs. Graduate and Student Section. "Some Applications of Digital Computing Machines," by Dr. A. D. Booth.

Tuesday, 4th February

CAMBRIDGE.—Cavendish Laboratory, Free School Lane, 8 p.m. I.E.E. Cambridge Radio and Telecommunication Group. "Problems of Sound and Television Broadcasting Coverage," by G. Millington.

CHELMSFORD. — Public Library, 7 p.m. I.E.E. London Graduate and Student Section. "Transistor Amplifier Circuits," by W. A. Thorpe.

DERBY.—E.M.E.B. Service Centre, 6.30 p.m. I.E.E. East Midland Centre. "Automatic Circuit Reclosers," by G. F. Peirson, A. H. Pollard and N. Care.

DUNDEE. — Technical College Hall, Bell Street, 7.30 p.m. Institution of Production Engineers, Dundee Section. "Technical Training and Professional Status," by the Earl of Halsbury.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "Electric Control of Stage and Television Lighting," by F. P. Bentham.

HAMMERSMITH. — Windsor Castle Hotel, 134, King Street, 7 p.m. A.S.E.E. West London Branch. "Power Factor Correction," by F. Moores.

LEEDS.—C.E.G.B., 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "Results of Full-Scale Stability Tests on the British 132 kV Grid System," by Dr. Ing. F. Busemann and W. Casson.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section (in conjunction with the British Nuclear Energy Conference). "Temperature Transients in Gas-Cooled Thermal Nuclear Reactors," by J. H. Bowen and E. F. O. Masters; "Boron-Trifluoride Proportional Counters." "The Design, Performance and Use of Fission Counters," by W. Abson, P. G. Salmon and S. Pyrah; and "The Application of Digital Computers to Nuclear-Reactor Design," by Dr. J. Howlett.

Electrical Association for Women, London Branch, 2.15 p.m. Visit to the National Grid Control Room, Bankside House, S.E.1.

MANCHESTER.—Engineers' Club, 17, Albert Square, 7 p.m. I.E.E. North-Western Centre. "18th Century Developments in Visual Teaching in a Medical Speciality," by Professor W. I. C. Morris.

The Engineers' Club. Combustion Engineering Association, North-Western Region. 10 a.m., "Brains Trust." 2.30 p.m., "Automatic Regulation of Combustion Conditions—Small and Medium Size Boilers," by E. Burman.

NEWCASTLE-UPON-TYNE. — Crown Hotel, Clayton Street West. A.S.E.E. Tyneside Branch. First annual dinner.

STOKE-ON-TRENT.—North Stafford Hotel, 6 p.m. I.E.S. Stoke-on-Trent Group. Film evening.

Wednesday, 5th February

BURTON-ON-TRENT. — Electricity Service Centre, 6.30 p.m. I.E.E. North Staffordshire Sub-Centre. "Electrical Floor Warming," by J. W. Moule and W. M. Stevenson.

EDINBURGH.—Y.M.C.A. Concert Hall, 14, South Saint Andrew Street, 7.30 p.m. I.E.S. Edinburgh Centre and Edinburgh Electrical Society (joint meeting). "Modern Trends in Cold Cathode Lighting," by E. A. Langsdon.

North British Hotel, 7.30 p.m. Institution of Production Engineers, Edinburgh Section. "Technical Training and Professional Status," by the Earl of Halsbury.

GLASGOW.—39, Elmbank Crescent, C.2, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Electric Control of Stage and Television Lighting," by F. P. Bentham.

39, Elmbank Crescent, 8 p.m. A.S.E.E. Glasgow Branch. "Fluorescent Fittings and Fault Finding," by L. C. Rettig.

HALIFAX.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Some Applications of Electronic Equipment," by A. Smith.

HARRINGAY.—Queen's Head, 677, Green Lanes, N.4, 7.45 p.m. A.S.E.E. North London Branch. "Public Address Systems," by J. M. McCall.

HOVE.—S.E.E.B. Offices, 6.30 p.m. I.E.E. Southern Centre. "Earthing of Low- and Medium-Voltage Distribution Systems and Equipment," by F. Mather.

LONDON. — Connaught Rooms, W.C.2, 7 for 7.30 p.m. I.E.E. Supply Section. Dinner-dance.

I.E.E. London Graduate and Student Section. 2.30 p.m. Visit to the Otis Elevator Co., Ltd., Falmouth Road, S.E.1. 6.30 p.m. At the Institution, Savoy Place, W.C.2. Film evening.

At the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "Radio Investigations during the I.G.Y.", by Dr. W. J. G. Beynon.

Burlington House, W, 3 p.m. Royal Society. Discussion on "Experimental Results with the Zeta Apparatus on Controlled Thermonuclear Reactions," opened by Sir John Cockcroft.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. North Eastern Centre chairman's address, by T. W. Wilcox.

NEWCASTLE-UPON-TYNE. — King's College, College Road, 6.15 p.m. I.E.S. Newcastle-upon-Tyne Branch. "Lighting Research at the Building Research Station," by R. G. Hopkinson.

PRESTON.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "Earth Leakage Protection of Domestic and Similar Installations," by J. A. Robbins.

SWANSEA.—South Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. "Modern Applications of Plastics to Lighting Fittings," by P. H. Collins.

TAUNTON.—S.W.E.B. Showrooms, 7 p.m. I.E.E. Bristol Graduate and Student Section. Repeat of chairman's address, "Some Current Trends in Electricity Supply," by T. E. B. Caseley.

Thursday, 6th February

BRISTOL. — The University, 6.30 p.m. Institution of Production Engineers. "Technical Education for Production Engineers," by Lord Hives.

EDINBURGH. — Charlotte Rooms. I.E.E. South-East Scotland Sub-Centre. Joint dance with the Institution of Civil Engineers.

GLASGOW.—39, Elmbank Crescent, 7.30 p.m. Institution of Production Engineers, Glasgow Section. "Technical Training and Professional Status," by the Earl of Halsbury.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Kelvin lecture on "High Polymers," by Dr. H. W. Melville.

MANCHESTER. — College of Technology, Sackville Street, 6.30 p.m. British Institution of Radio Engineers, North Western Section. "Electronic Musical Instruments," by A. Douglas.

NOTTINGHAM. — E.M.E.B. Smithy Row, 6 p.m. I.E.S. Nottingham Centre. "Light and Plant Growth," by Dr. Daphne Vince.

SOUTHAMPTON.—Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. "Southern Region Electrification," by W. J. Sykes.

Friday, 7th February

BIRMINGHAM.—Grand Hotel, 6.30 p.m. I.E.E. South Midland Centre. Annual dinner.

Imperial Hotel, 7.30 p.m. Incorporated Plant Engineers, Birmingham Branch. Annual dinner.

BRISTOL.—Grand Hotel, Broad Street, 8 p.m. A.S.E.E. Bristol and West of England Branch. "The Diesel Generator as a Composite Heat and Power Generator," by F. J. Buxton.

HATFIELD.—Hatfield Technical College, 7 p.m. I.E.E. district meeting. "Colour Television," by P. C. Kidd.

IPSWICH. — Great White Horse Hotel. Ipswich and District Electrical Association. Annual dinner.

LIVERPOOL.—At the Liverpool Engineering Society, 9, The Temple, 24, Dale Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "X-Ray Tubes and their Problems," by L. C. Maple.

SALE.—Embassy Suite (Locarno), Washway Road, 6.45 for 7.15 p.m. I.E.E. North Western Utilisation Group. Annual dinner-dance.

STOKE-ON-TRENT.—Grand Hotel, Hanley, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Power Supply and Distribution in North Staffs," by C. C. Pimble.

Saturday, 8th February

LONDON.—I.E.E. London Graduate and Student Section. Visit to Sadler's Wells Theatre (10 a.m.).

MANCHESTER.—Café Royal, Peter Street. Incorporated Plant Engineers, Manchester Branch. Ladies' evening.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Ackworth.—Parish Council. 20th February. Street lighting equipment. (See this issue.)

Antrim.—County Education Committee. 24th February. Electrical installation at Carrickfergus Intermediate School. J. R. W. Murland, M.I.E.E., consulting engineer, 13, Wellington Place, Belfast.

Ashford (Kent).—U.D.C. 7th February. Electric lamps (Contract No. 14), for the year ending 31st March, 1959. Surveyor, 1, Elwick Road.

Belfast.—Electricity Department. 21st February. Electrical stores. (See this issue.)

Deal.—Borough Council. 12th February. Electric lamps for one year. Borough treasurer, 12, Victoria Road.

Hemel Hempstead.—Borough Council. 17th February. Electric lamps (Contract No. 21), for the year ending 31st March, 1959. A. B. Turner, borough engineer, High Street.

Hornsey.—Borough Council. 19th February. Improvements to school lighting installation. (See this issue.)

India.—Hindustan Steel Private, Ltd., Rourkela. 7th February. 4,000 kVA transformer. (E.S.B. 1703/58. Ten/30475.)*

Madras State Electricity Board. 14th February. H.v. insulators. (E.S.B. 1684/58. Ten/30479.)*

Iraq.—Central Foreign Purchase Committee, Baghdad. 2,000 ceiling fans. (E.S.B. 1792/58. Ten/30501.)*

Lymington.—Borough Council. 10th February. Electric lamps for the year ending 31st March, 1959. Borough engineer, Town Hall.

New Zealand.—Dunedin Corporation. 26th February. 150 high rupturing capacity pole fuses with cartridges. (E.S.B. 1532/58. Ten/30431.)*

Norwich.—Town Council. 10th February. Electric lamps and torch batteries for the year ending 31st March, 1959. H. C. Rowley, city engineer, City Hall.

Pakistan.—Director General of Supply and Development, Chittagong. Train lighting belting. (E.S.B. 1707/58. Ten/30473.)*

Posts and Telegraphs Department. 10th February. Lightning arrestors and electric bells. (E.S.B. 1060/58. Ten/30367.)* 11th February. Milliameters and detectors. (E.S.B. 1059/58. Ten/30366.)*

Poole.—Borough Council. 17th February. Electric wiring supplies and accessories; electric lamps; batteries; and electric street lighting lanterns, for the year ending 31st March, 1959. Borough engineer, Municipal Buildings.

Portuguese East Africa.—Ports, Railways and Transport Department. 14th March. Radio communication equipment for marshalling yard. (E.S.B. 1250/58. Ten/30372.)*

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 7th February. Telephone cable. (E.S.B. 1645/58. Ten/30445.)* Electric cable. (E.S.B. 1642 and 1644/58. Ten/30456-7.)*

Salisbury Electricity Department. 18th February. Test room equipment. (E.S.B. 1483/58. Ten/30419.)*

Salford.—Corporation. 4th February. Street lighting equipment and materials. (See this issue.)

Solihull.—Corporation. 15th February. Trunk road lighting equipment. (See this issue.)

South Africa.—Union Tender and Supplies Board, Pretoria. 6th February. Telephone switchboards. (E.S.B. 1412/58. Ten/30453.)*

Tynemouth.—Borough Council. 17th February. Electric lamps and cable; lamp columns, lanterns and fittings; and housing electrical accessories for the year ending 31st March, 1959. D. M. O'Herlihy, borough surveyor, 16, Northumberland Square, North Shields.

Warminster.—U.D.C. 22nd February. Street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Carlisle.—Corporation. Accepted. Electrical installations in 40 houses being built on the Morton estate and in Victoria Road (£1,018).—Hartley Electromotives, Ltd.

Chertsey. — U.D.C. Lighting units in various streets (£7,439).—Engineering & Lighting Equipment Co.

Felling (Durham).—U.D.C. Accepted. Electrical materials for street lighting on the Leam Lane estate (£2,115).—Revo Electric Co., Ltd.

London.—British Transport Commission. Supervisory control equipment for the remote control of switchgear on the Manchester-Crewe electrification.—Automatic Telephone & Electric Co. Supervisory control equipment for the remote control of switchgear on the Colchester-Clacton branch electrification.—Standard Telephones & Cables.

St. Albans.—City Council. Recommended. Electrical work at Block "A" on the Torrington House site (£1,437).—Giffens.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Bagshot.—First phase of county secondary school (£43,119); Surrey county architect, County Hall, Kingston-on-Thames.

Bedlington.—Housing schemes at Morpeth Road, Cleasewell Hill and Guide Post for U.D.C.; A. K. Dennis, surveyor.

Bedworth.—Shops, flats and maisonnettes, Chapel Street; Morris & Jacombs, Ltd., builders, 71, Hobmoor Road, Birmingham.

Birmingham.—Multiple stores, Bartley Green; E. Woodbourne, architect, F. W. Woolworth & Co., Ltd., 1, New Bond Street, London, W.1.

Showrooms and offices, Bull Street; Stead & Simpson, Ltd., 12, Belgrave Gate, Leicester.

Brighton.—Shops and flats, Eldred Way; T. J. Braybon & Son, Regent House, Princes Place.

Factory extension for Brighton Sheet Metal Works, Lower Bevendean; James Miller & Partners, builders, 7, Suffolk Street, S.W.1.

Bristol.—Seven-storey block of offices and showrooms for the Equity & Law Life Assurance Society (£175,000); George Brown & Partners, architects, Brunel House, Bristol, 1.

Calne and Chippenham.—Houses (62), on sites at Biddlestone, Bremhall, Corsham Regis and Pewsham, for R.D.C.; surveyor, Bewley House, Marshfield Road, Chippenham.

Camborne-Redruth.—Houses and flats (52), for U.D.C.; clerk, Council Offices, Camborne, Cornwall.

Cannock.—Houses (144), Great Wyrley; J. P. Roberts, clerk to R.D.C., Council Offices, Penkridge, Stafford.

Carshalton.—Large extensions to the Technical Institute (£174,945); county architect, County Hall, Kingston-on-Thames.

Chelmsford.—Rebuilding shops and restaurant, 24-5, High Street; J. Lyons & Co., Ltd., Cadby Hall, London, W.14.

Chesterfield. — Crematorium; borough architect.

Cleethorpes.—Revised scheme for 32 flats for old people, Beacon Hill estate; borough architect.

Consett.—First part of proposed Trades Union Memorial Hall (£85,000); Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street.

Houses on a further 40 acres of land at Moorside and Leadgate; E. Simpkin, U.D.C. surveyor.

Coventry.—Shops, dance hall, etc., Smithford Way; A. G. Ling, city architect, Bull Yard, off Warwick Row.

Edgware.—Works extensions; Boosey & Hawkes, Ltd., Sonorous Works, Deansbrook Road.

Leicester.—Teaching block for University; Architects Co-Partnership, 44, Charlotte Street, London, W.1.

London.—Office block, 63, Grosvenor Street; H. Fairweather & Co., Ltd., builders, Hyde Works, St. James's Lane, N.10.

Extensions (£365,900) for Sir William Collins County School, St. Pancras; William Crabtree, architect, 8, Robert Adam Street, W.1.

Manchester.—Laboratory block for Christie Hospital and Holt Radium Institute, Wilmslow Road; Harry S. Fairhurst & Son, architects, 55, Brown Street.

University extensions, Oxford Road; J. W. Beaumont & Son, architects, Spring Gardens.

Police section station at Beswick and ambulance depot at Wythenshawe; city architect, P.O. Box 488, Town Hall.

Margate.—Factory extension for Algraphy, Ltd.; Grummant Bros., builders, 100, Grange Road, Ramsgate.

Middlesbrough.—Operating theatre at Hemlington Hospital for Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne; P. H. Knighton, Board's chief architect.

Morpeth.—Further reconstruction work at St. George's Hospital for Newcastle Hospital Board (£7,000); John Jackson and Sons, builders, Corporation Street, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Branch library, Denton Burn; city architect, 18, Cloth Market.

Northumberland.—School at Ashington for mentally backward children and adults (£26,000); county architect, County Hall, Newcastle-on-Tyne.

Oldham.—Houses (104), Alt estate; Cameron & Middleton, surveyors, 21, Queen Street, Oldham.

Peterlee.—Flats (48), Dene House, for Peterlee Development Corporation; A. V. Clerey & Son, builders, 14, Frederick Street, Sunderland.

Shepperton.—Reconstruction at British Lion Films Studios; Kyle Stewart, Ltd., contractors, 338, Kilburn High Road, London, N.W.6.

Stalybridge.—Works extensions; Clifford Butterworth & Co., Ltd., Peel Street.

Stretford.—Laboratory and offices; W. H. Cowburn & Cowpar, Ltd., Trafford Park Road.

Sunderland.—Three-storey flats, Villette Brook Street, for P. R. C. Allison; G. T. Brown & Son, architects, 53, Fawcett Street.

Houses (72), High Barnes estate; J. W. Ridley, Ltd., builders, Southwick, Sunderland.

West Bromwich.—Works extensions; Steelwork Constructors (1946), Ltd., Bull Lane.

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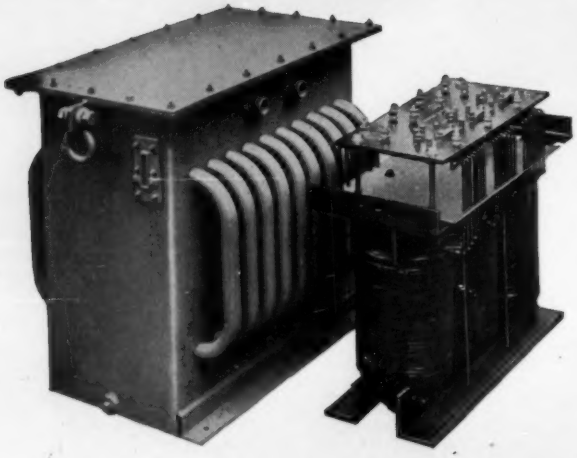

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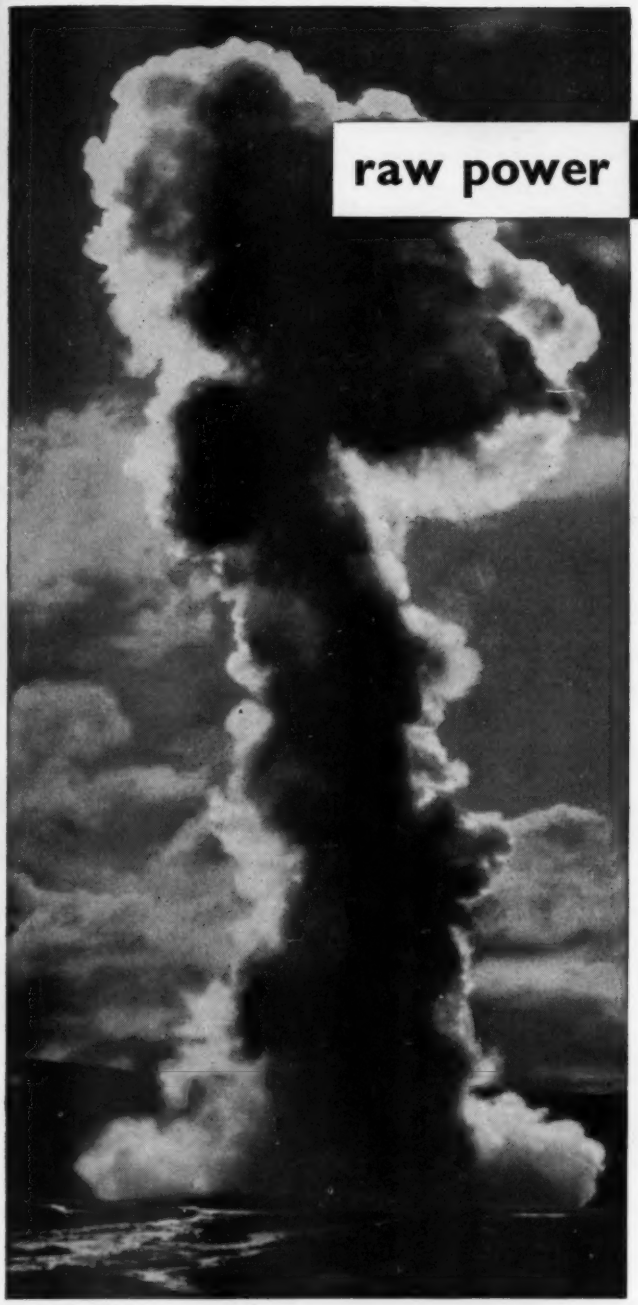

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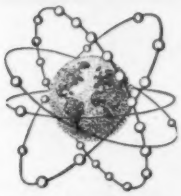

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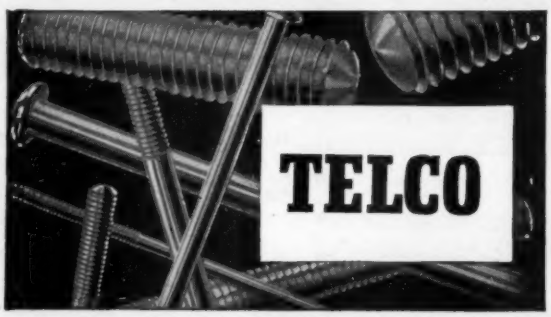

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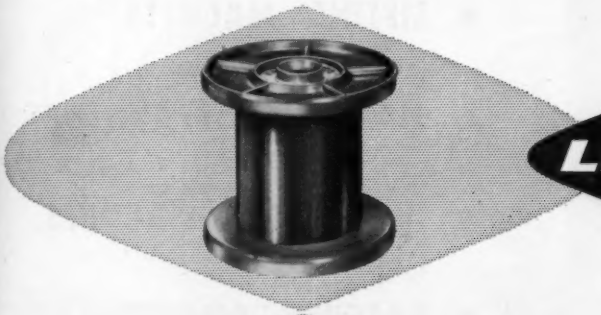

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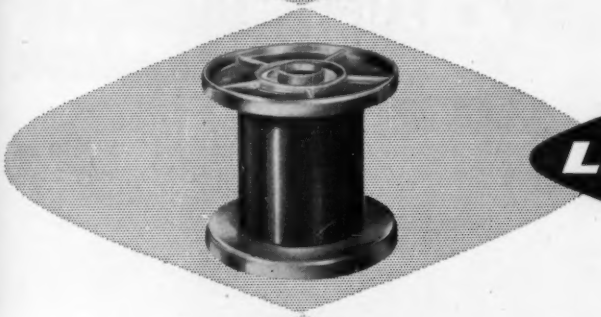

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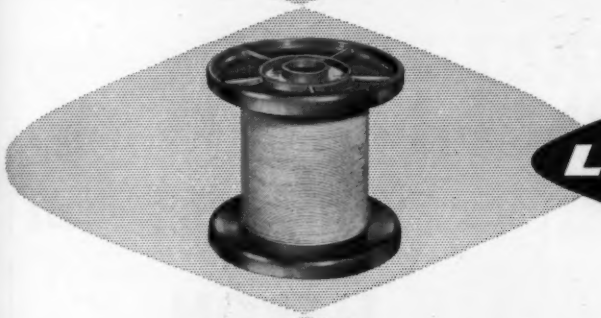
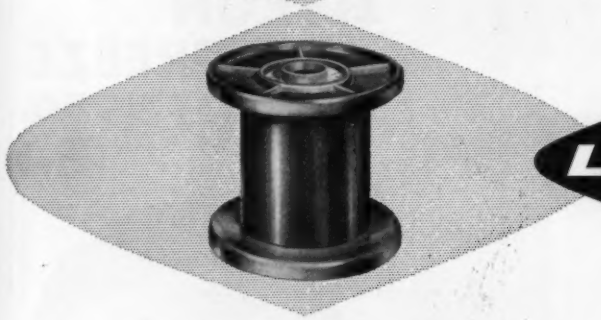


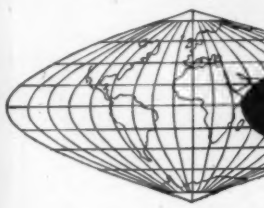
LEWCOGLASS

Glass covered, heat resisting wires with a relatively thin covering and high space factor. Available with either standard or silicone varnish.



LEWCOSOL

An enamelled wire which can be soldered or dip-tinned without prior removal of the insulating film.



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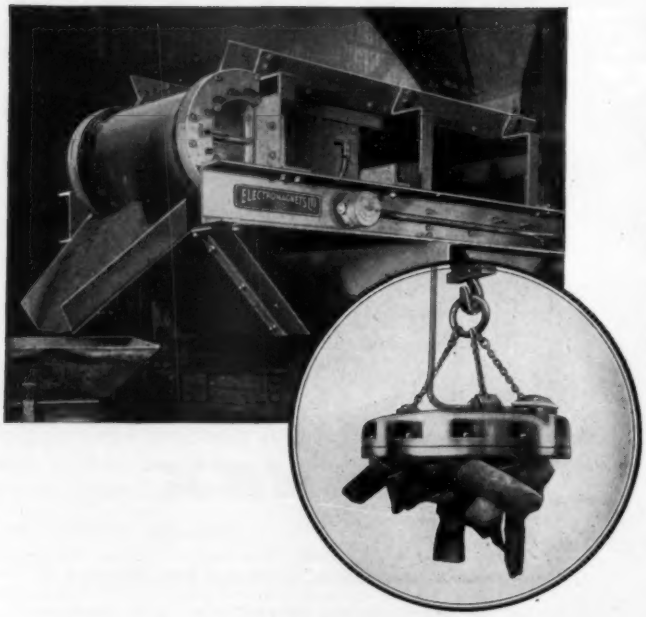

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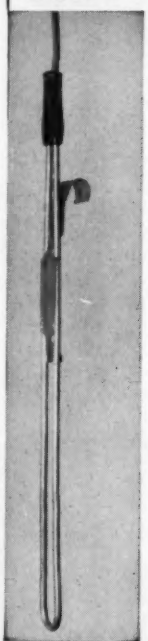

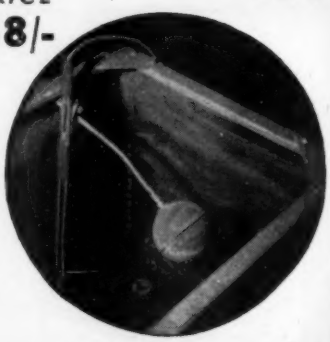

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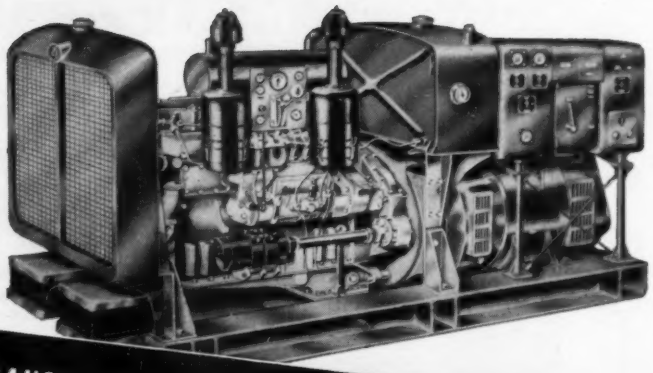

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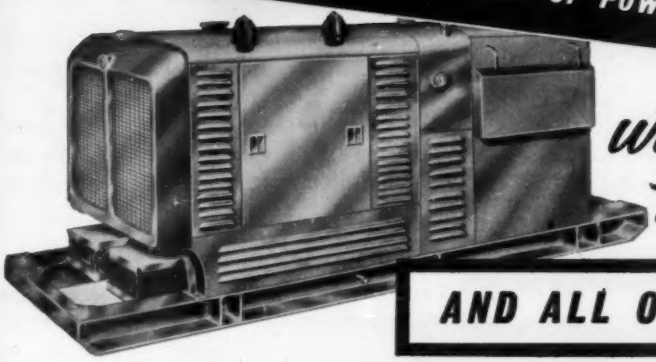

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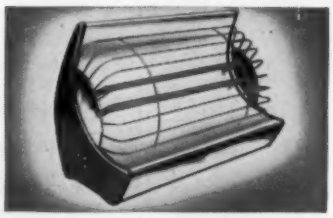
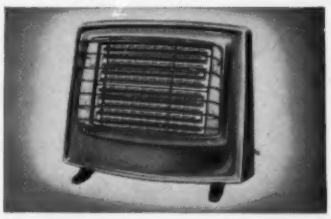


CRESCENT. Delightfully shaped model in enamelled sheet steel with electro-brightened anodised reflector, plated guard and pencil type elements 1 kw. or 2 kw. Colours: Welsh Grey, Cotswold Stone, Pale Gold, Gay Red.



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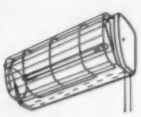
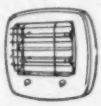
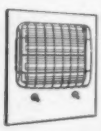


Swallow



New Outset



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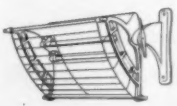

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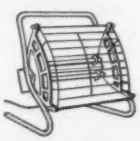

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13amp Ring Mains

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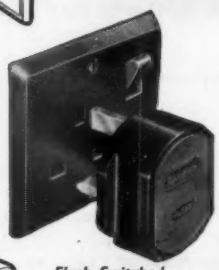

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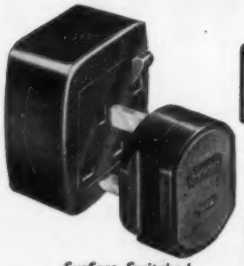

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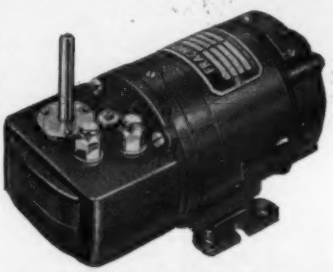

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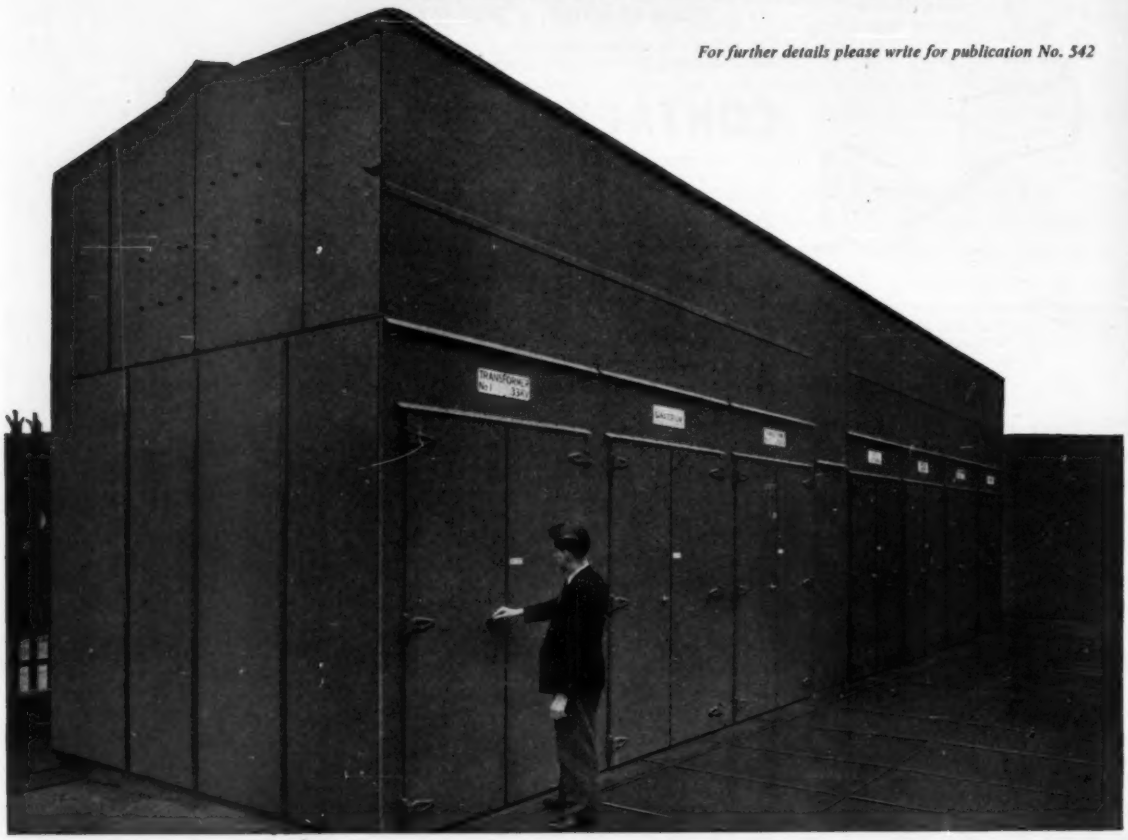

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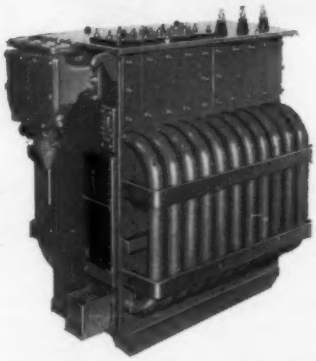

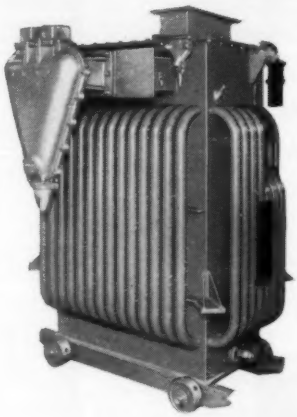

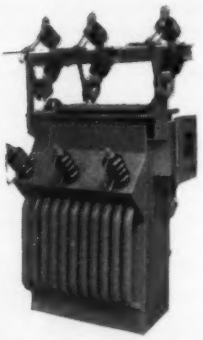

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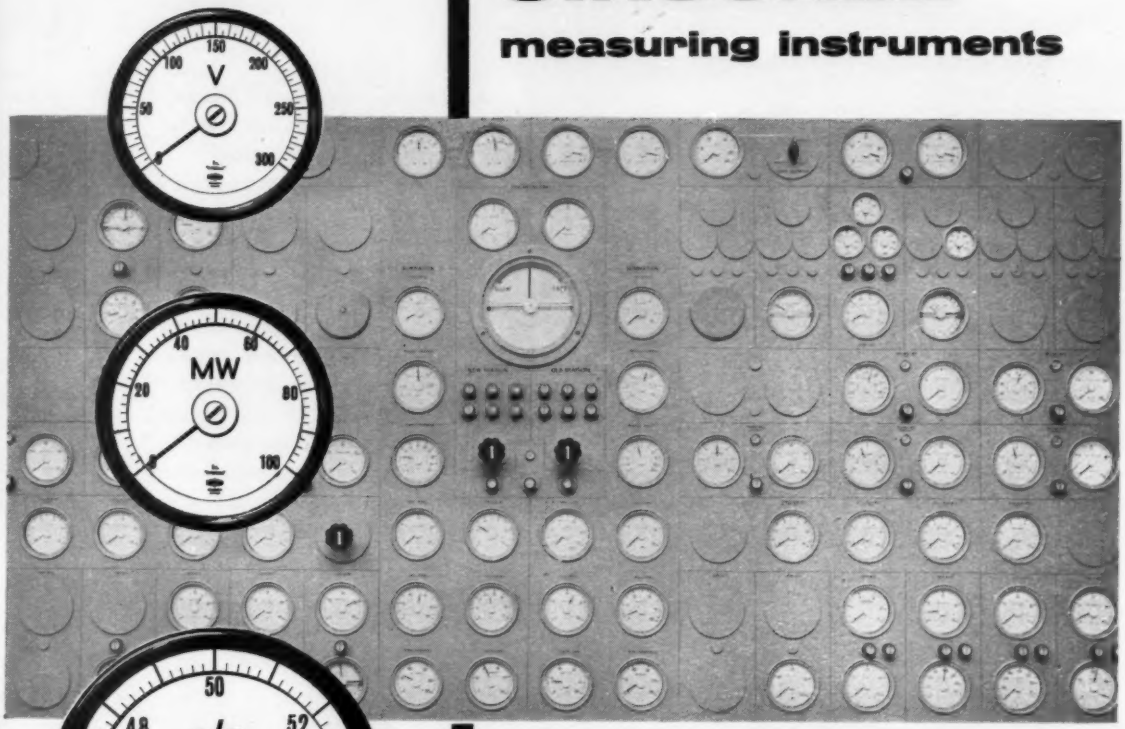

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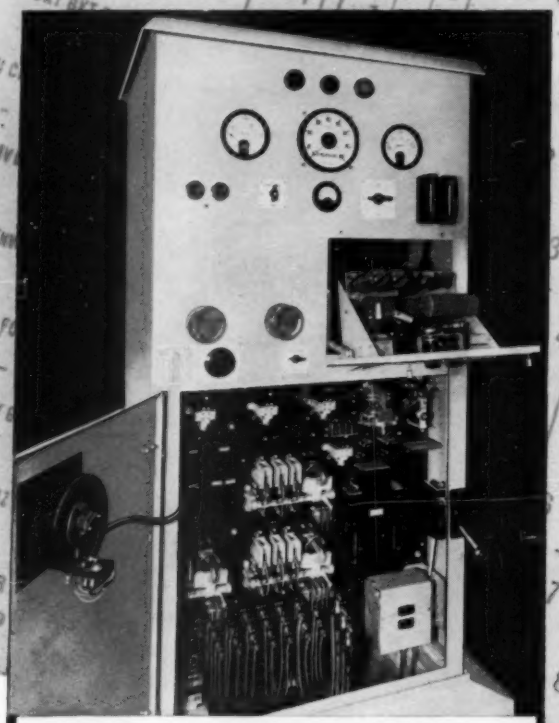

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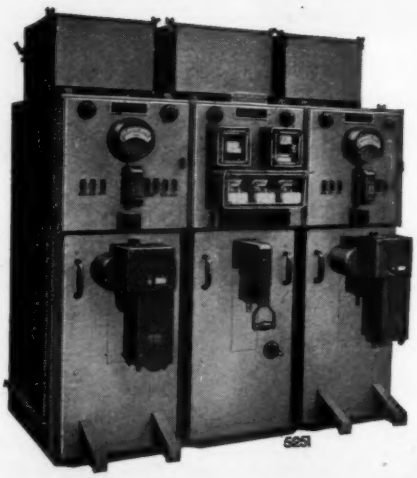

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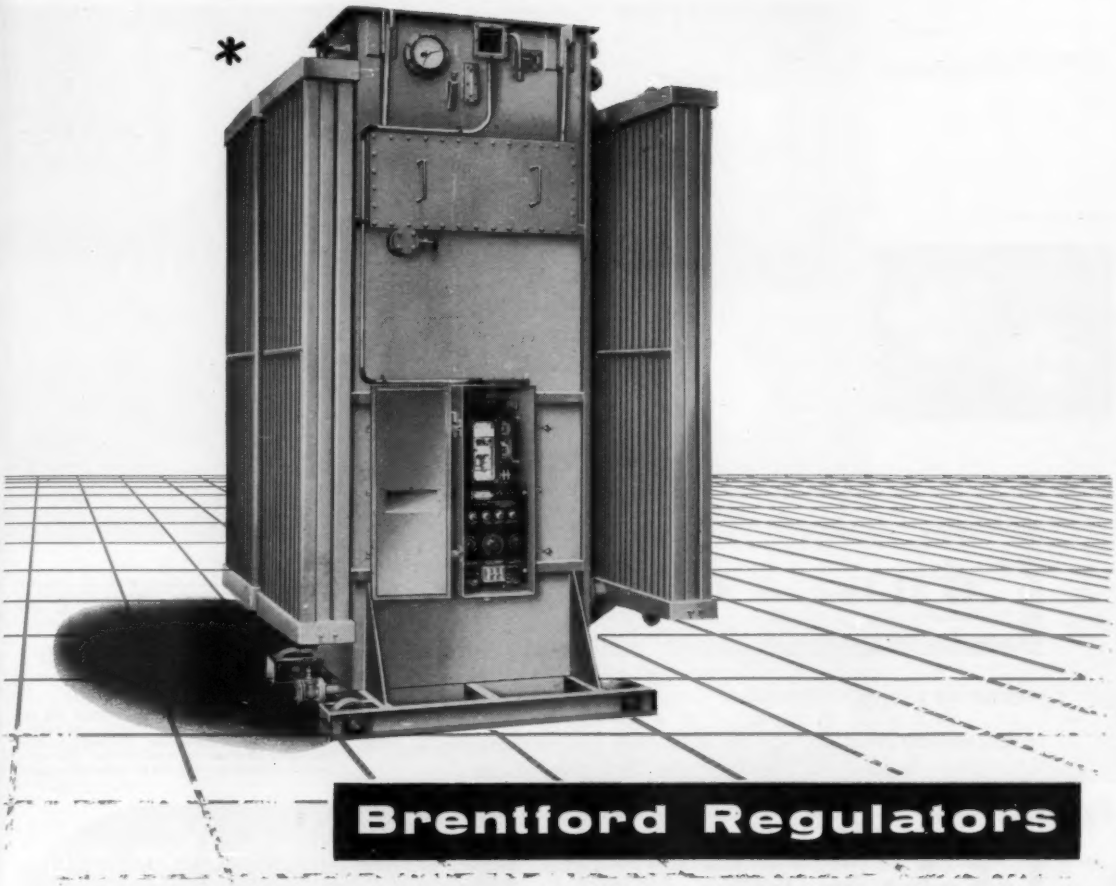

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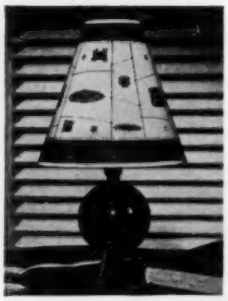

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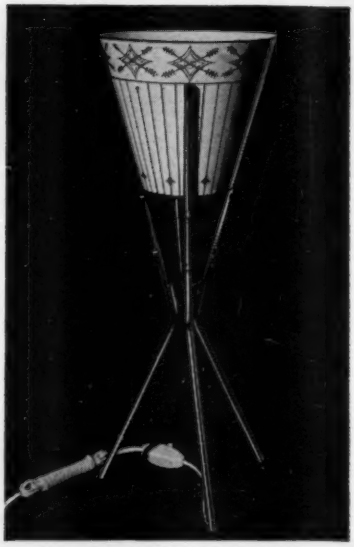

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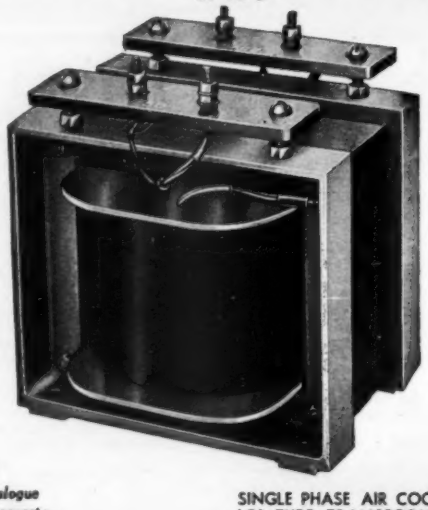

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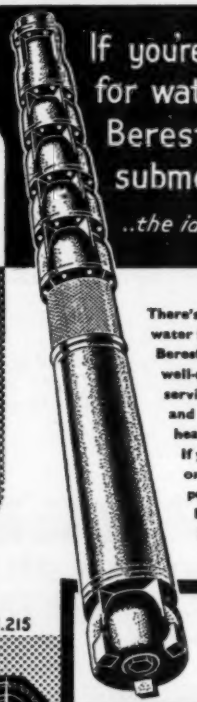

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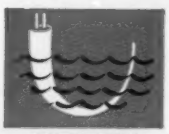
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WIDTH: 3"
F/CENTRES: 7½"
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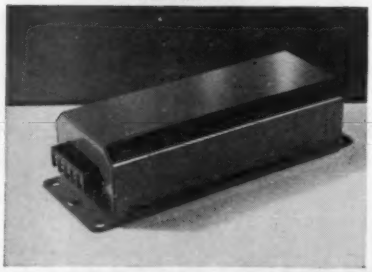

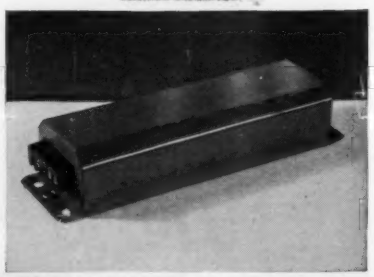

80 watt SLIM CHOKE
TYPE: 80/RSC
HEIGHT: 1 1/16"
WIDTH: 2⅝"
F/CENTRES: 8"
FINISH: GREY
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WITH CANISTER SWITCH HOLDER
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F/CENTRES: 13¾"
FINISH: WHITE
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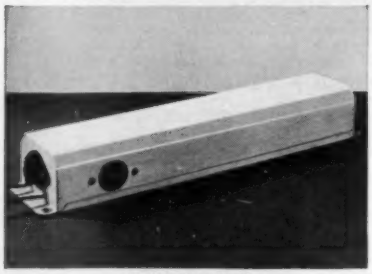

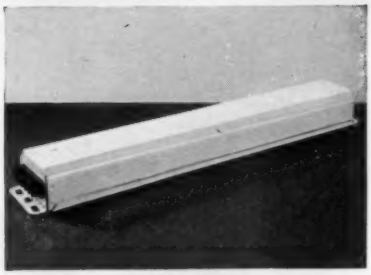

80 watt SLIM HPF BALLAST
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TYPE: 180/RSC
HEIGHT: 1 1/16"
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F/CENTRES: 16"
FINISH: WHITE
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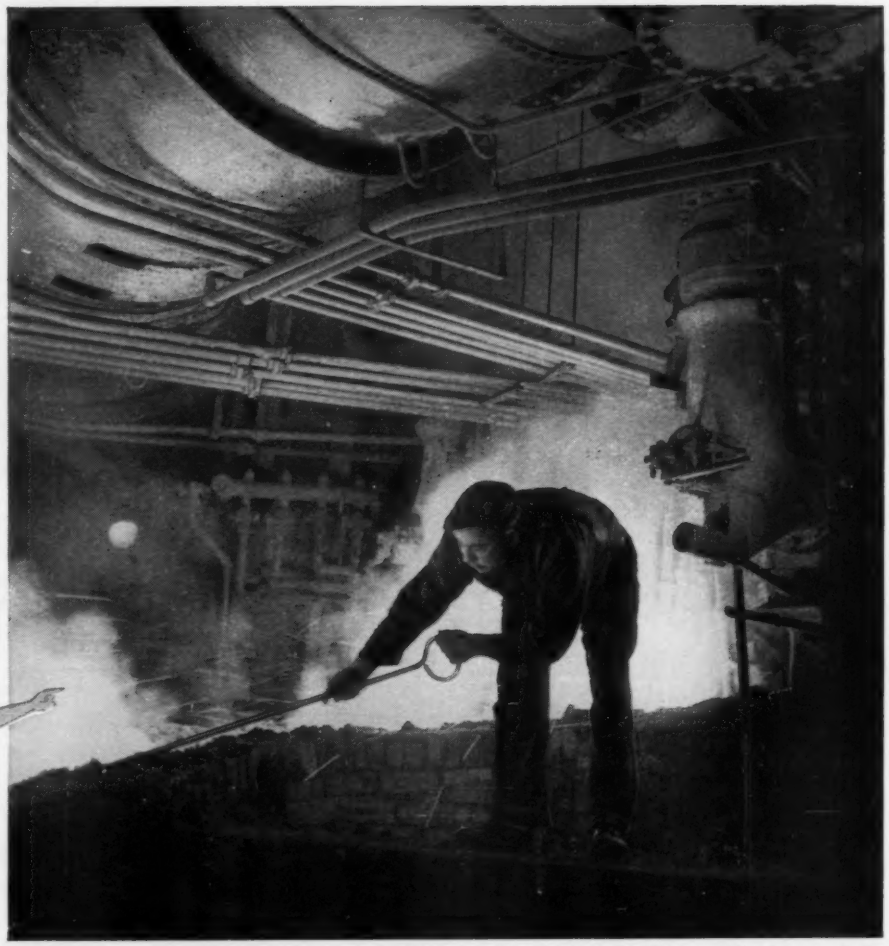

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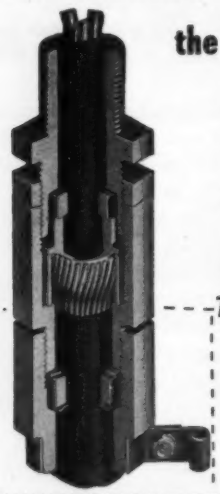

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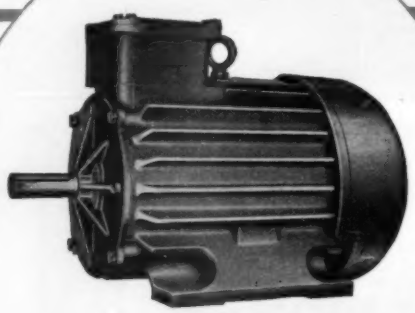

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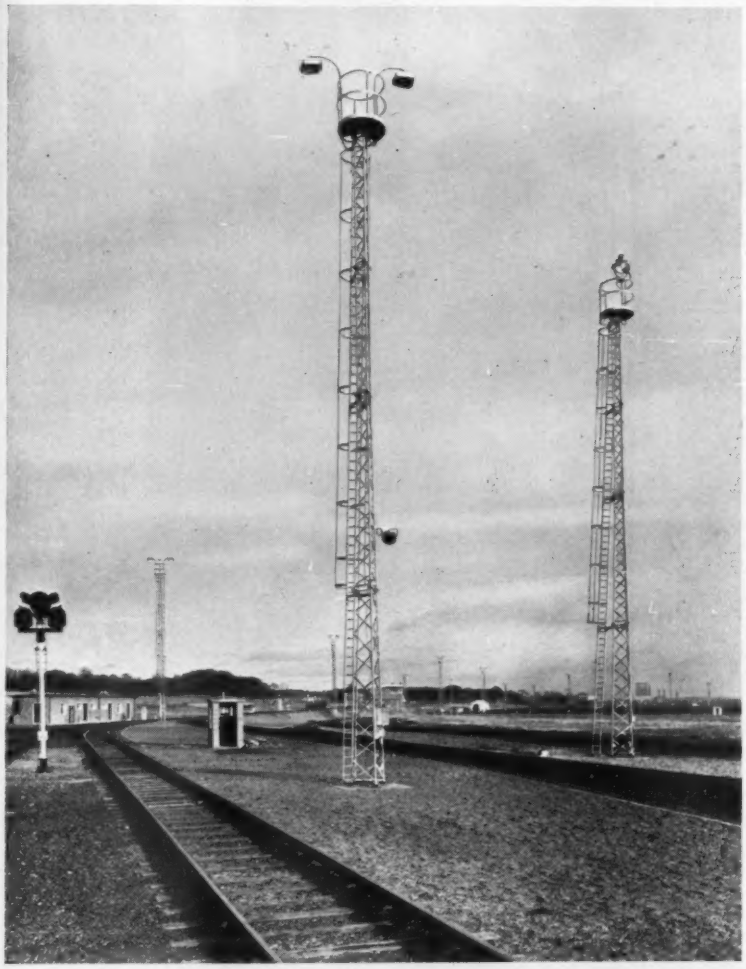

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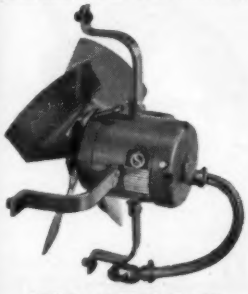

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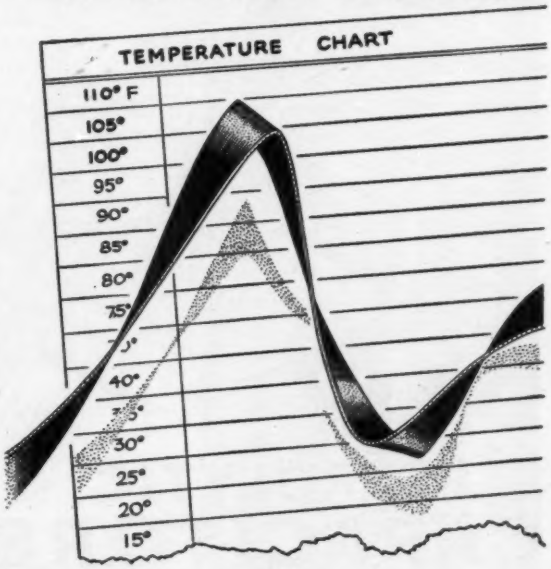

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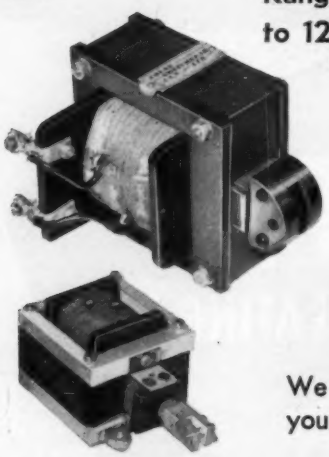

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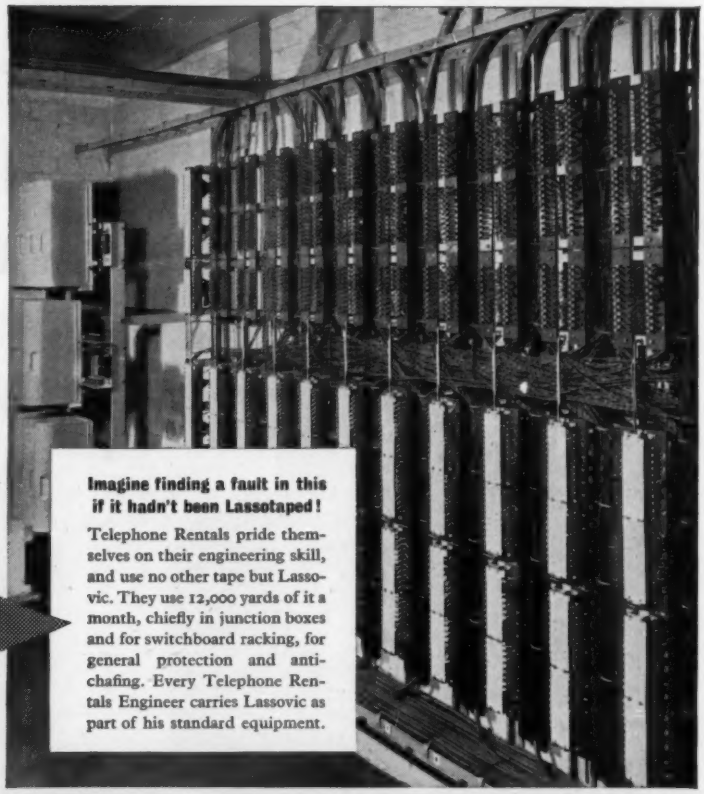

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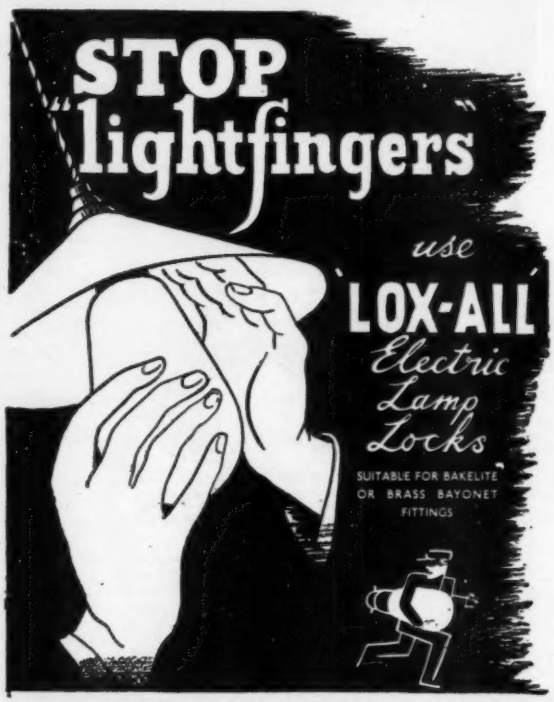

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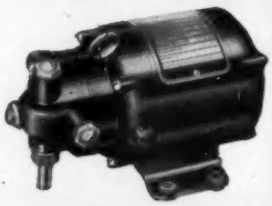

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R.P.M.	TORQUE	R.P.M.	TORQUE
600	10 oz. in.	37.5	4 lb. in.
300	16 oz. in.	25	4 lb. in.
150	24 oz. in.	18.8	4 lb. in.
100	32 oz. in.	12.5	4 lb. in.
75	36 oz. in.	9.4	4 lb. in.
50	3 lb. in.	6.25	4 lb. in.

SHADED-POLE INDUCTION GEARED MOTOR—Type 'FA'

R.P.M.	TORQUE	R.P.M.	TORQUE
216	4 oz. in.	13.5	24 oz. in.
108	7 oz. in.	9	30 oz. in.
54	10 oz. in.	6.7	38 oz. in.
36	12 oz. in.	4.5	2 lb. in.
27	15 oz. in.	3.35	3 lb. in.
18	20 oz. in.	2.25	4 lb. in.

VARIABLE SPEED GEARED MOTOR—Type 'KQ'

R.P.M.	TORQUE	R.P.M.	TORQUE
200-600	9 oz. in.	12-37.5	4 lb. in.
100-300	16 oz. in.	8-22	4 lb. in.
50-150	20 oz. in.	6-16.5	4 lb. in.
32-100	32 oz. in.	4-11	4 lb. in.
25- 75	40 oz. in.	3- 8.25	4 lb. in.
16- 50	48 oz. in.	2- 5.5	4 lb. in.

CAPACITOR INDUCTION GEARED MOTOR—Type 'N'

R.P.M.	TORQUE	R.P.M.	TORQUE
456	8 oz. in.	28.5	3 lb. in.
228	13 oz. in.	19	4 lb. in.
114	21 oz. in.	14.2	4 lb. in.
76	26 oz. in.	9.5	4 lb. in.
57	32 oz. in.	7.1	4 lb. in.
38	44 oz. in.	4.75	4 lb. in.

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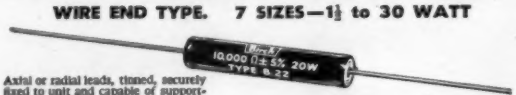

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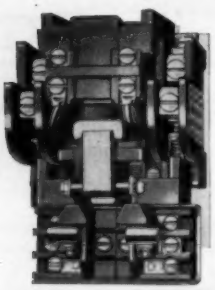

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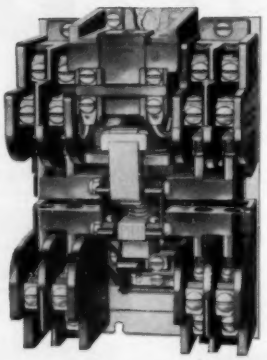

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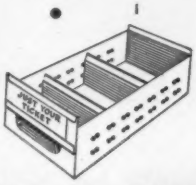

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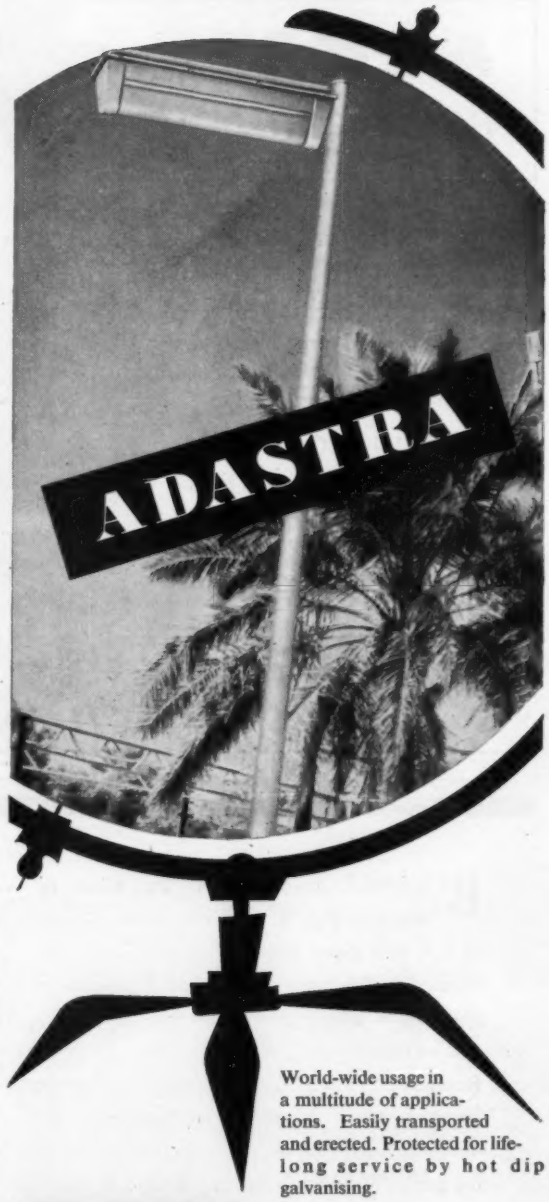

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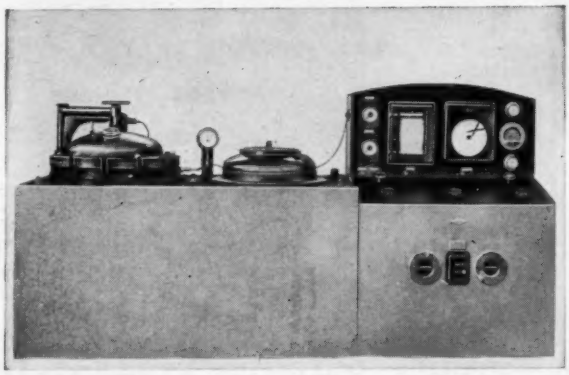

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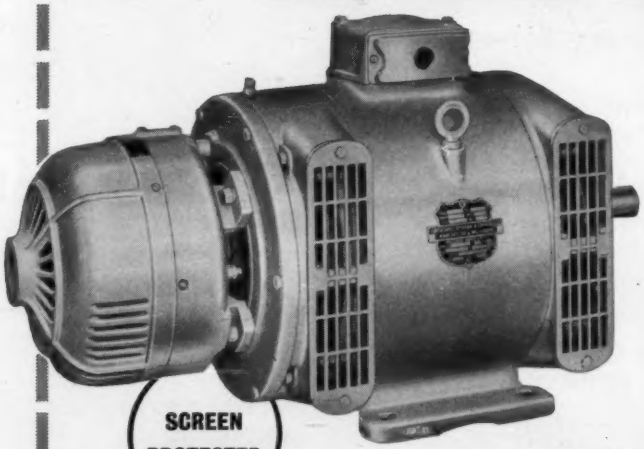

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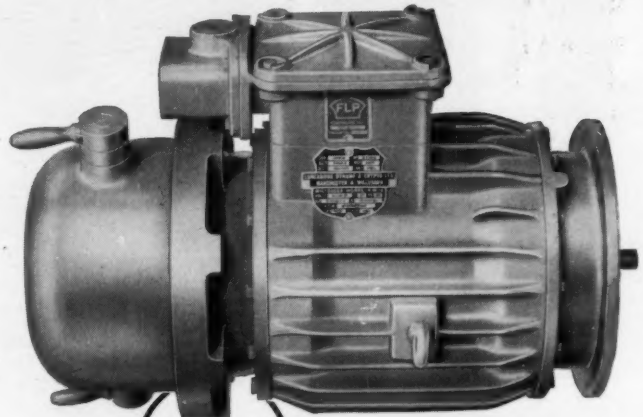

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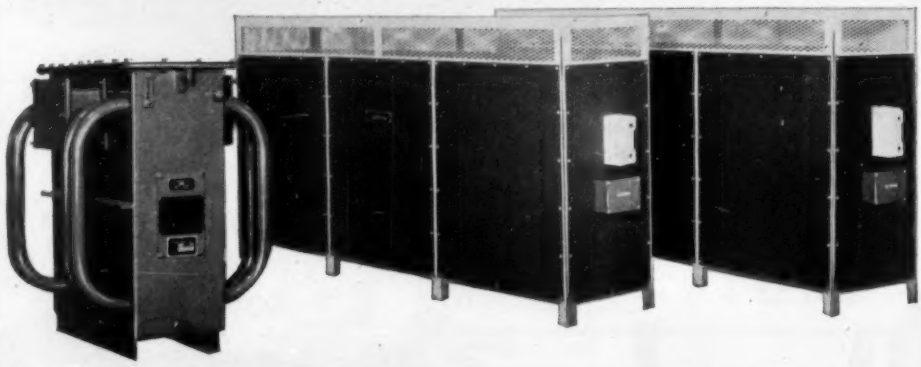

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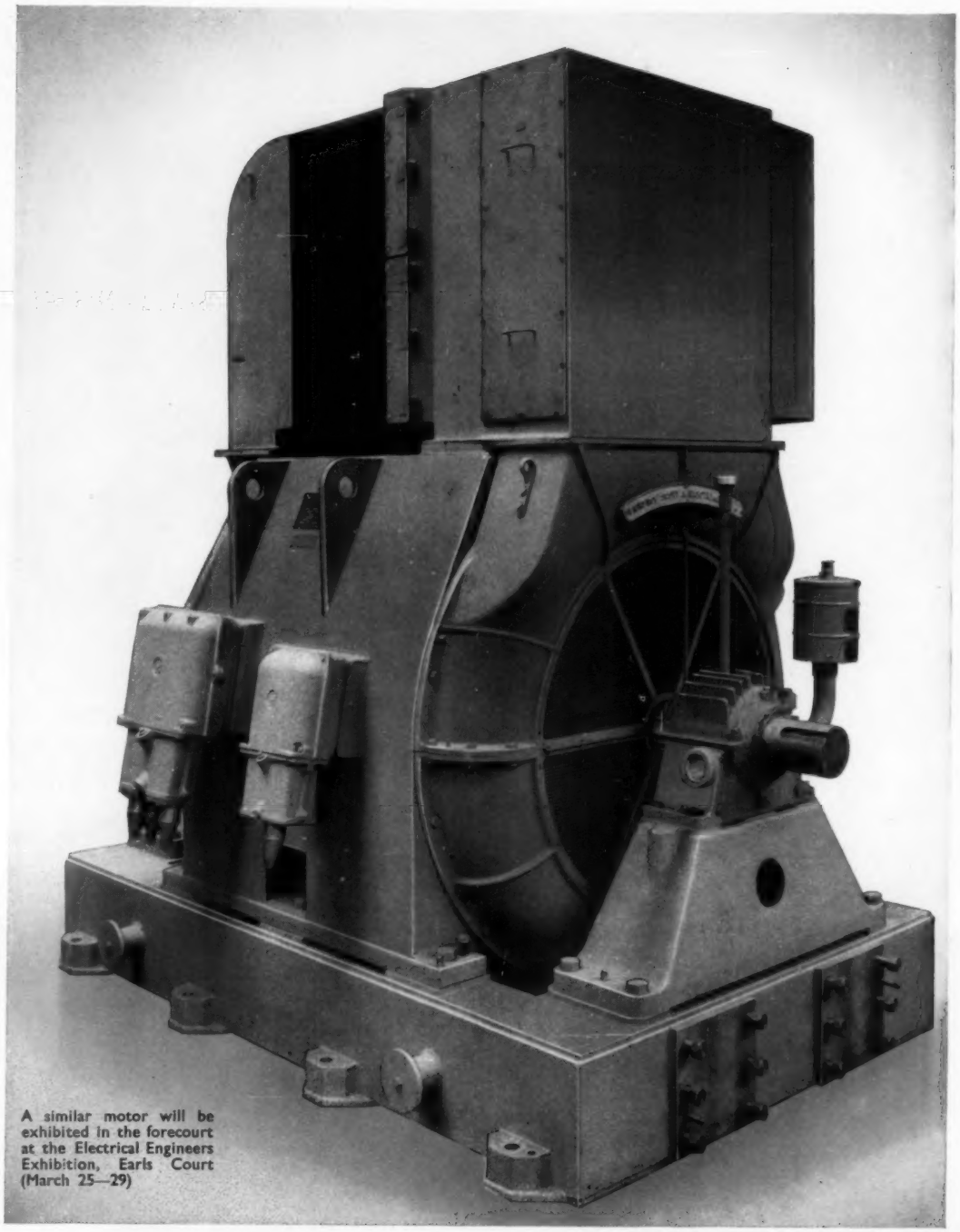

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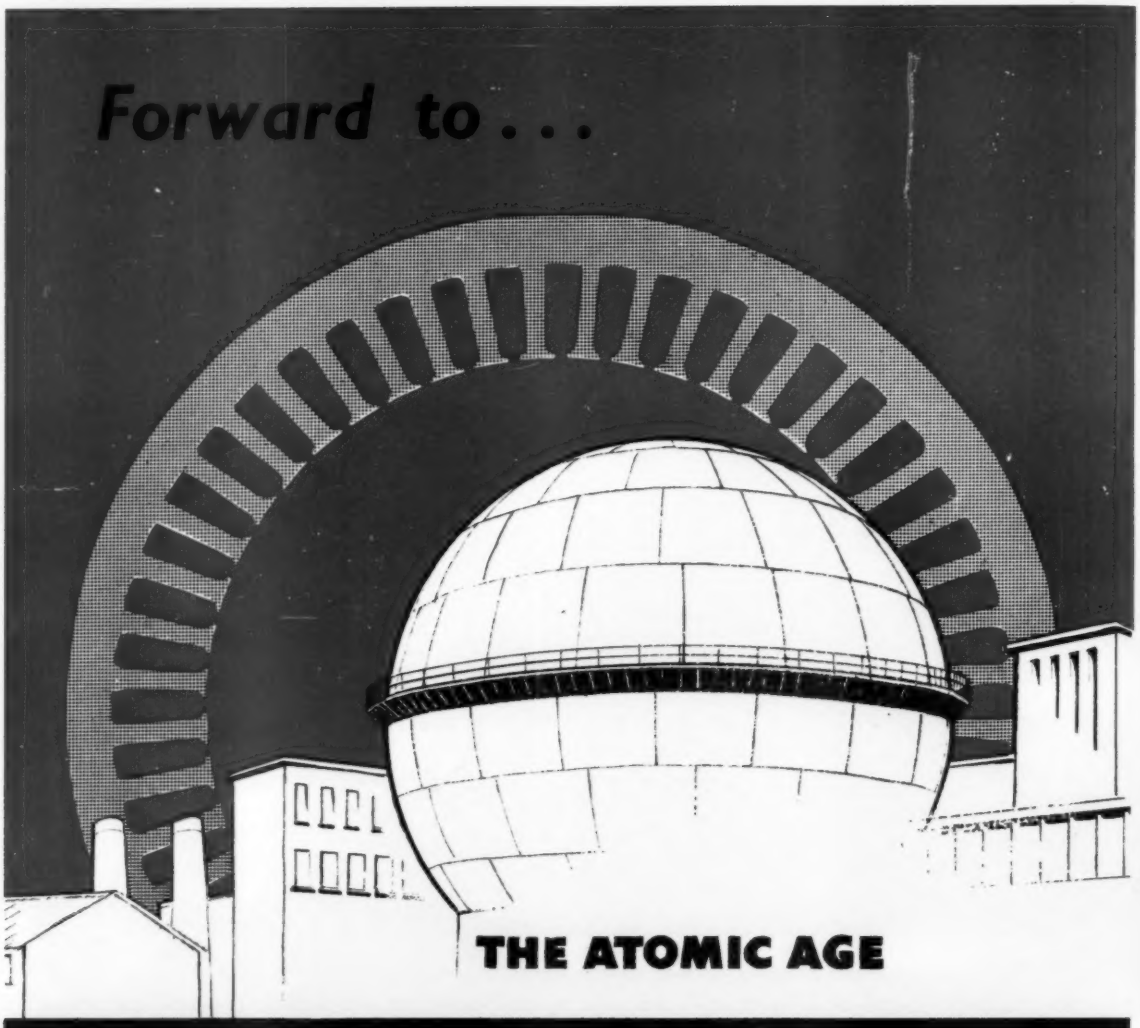

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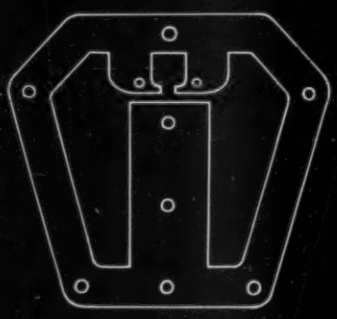

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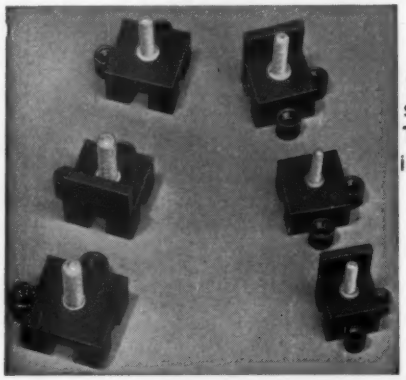

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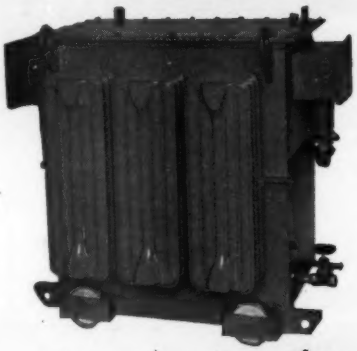

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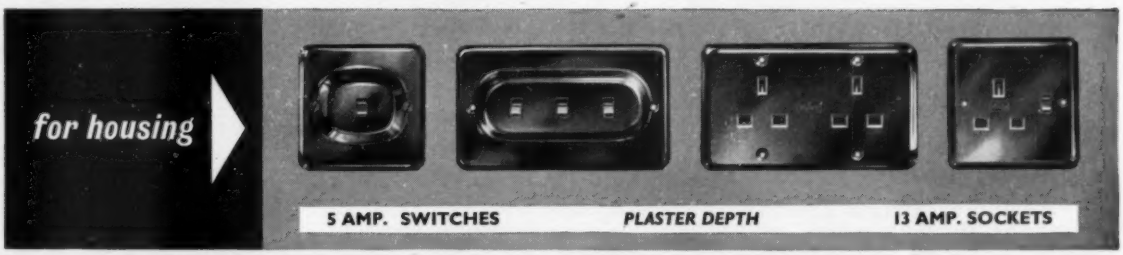

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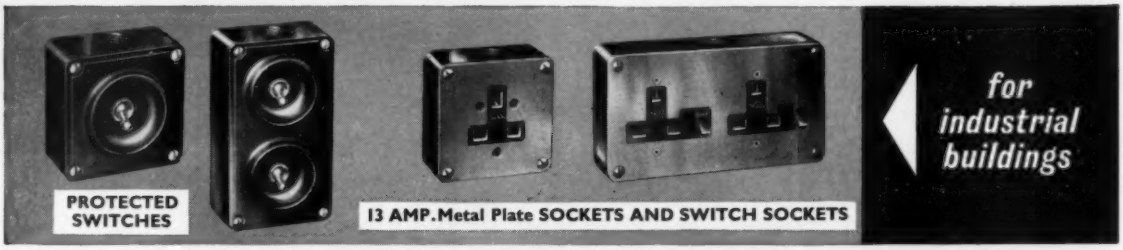

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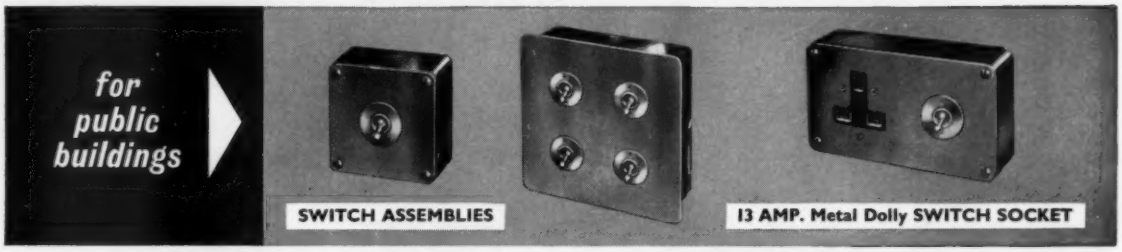

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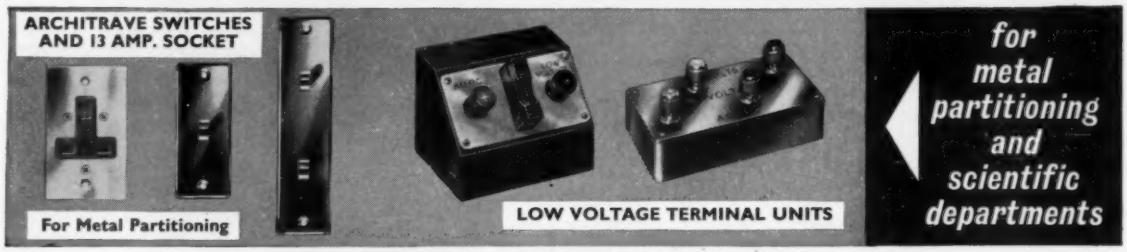
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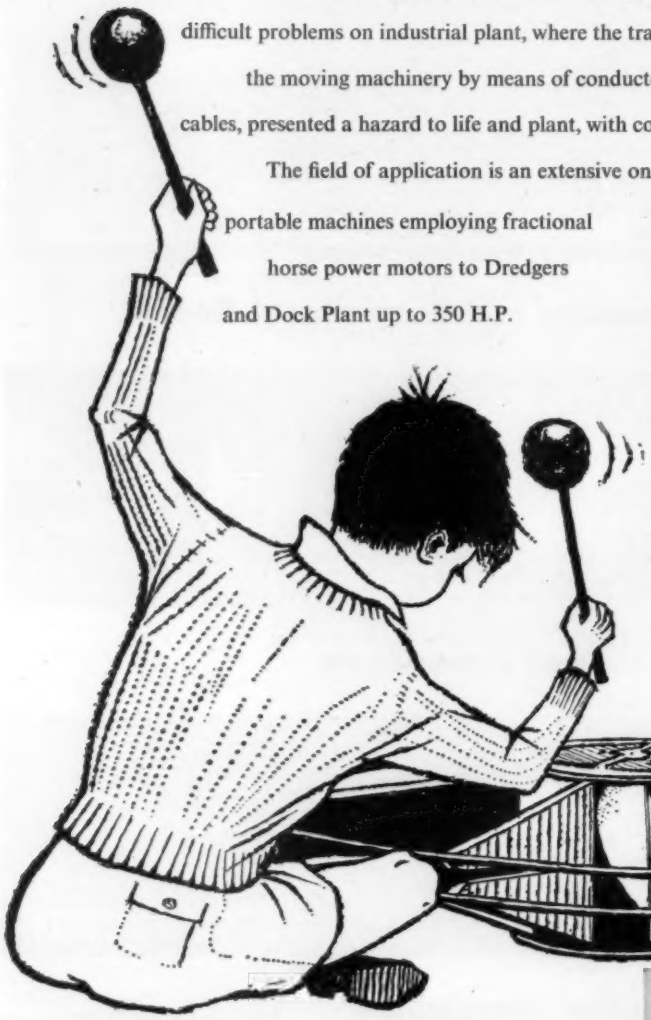

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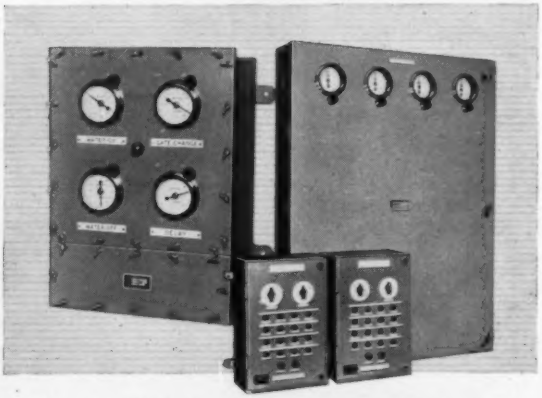

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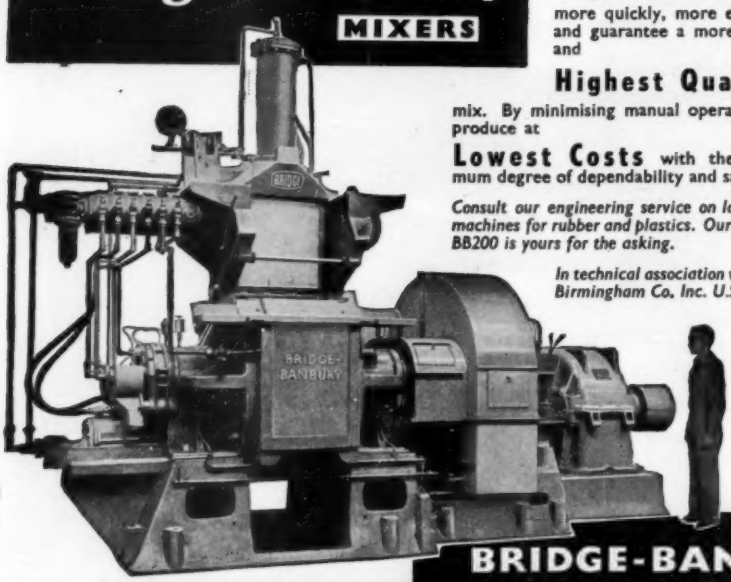

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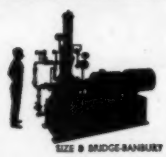
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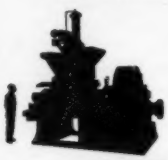
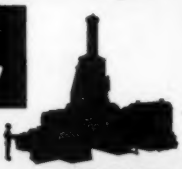
SIZE 3A BRIDGE-BANBURY


SIZE 9 BRIDGE-BANBURY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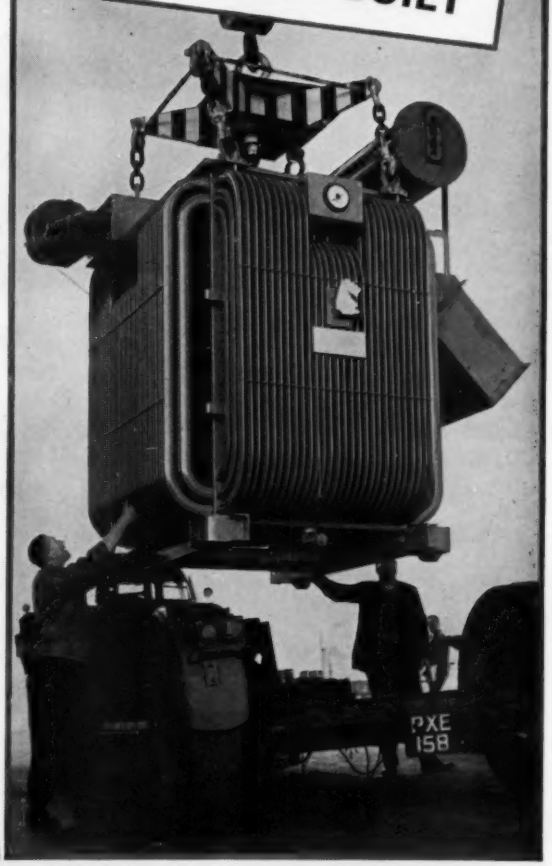

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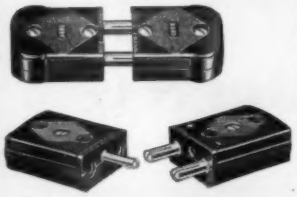

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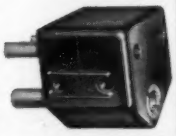

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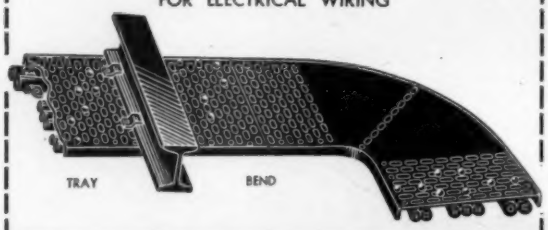

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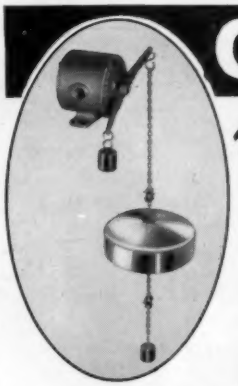

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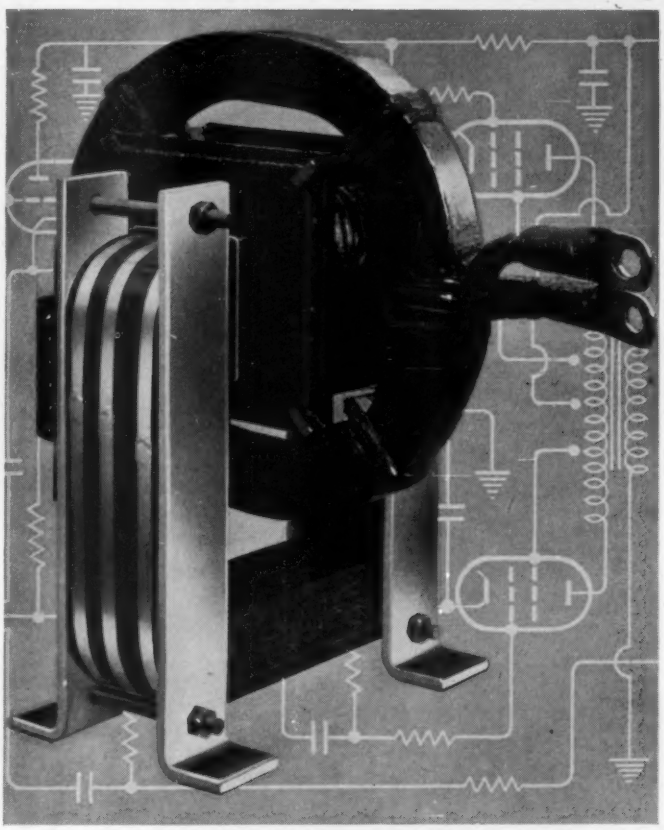

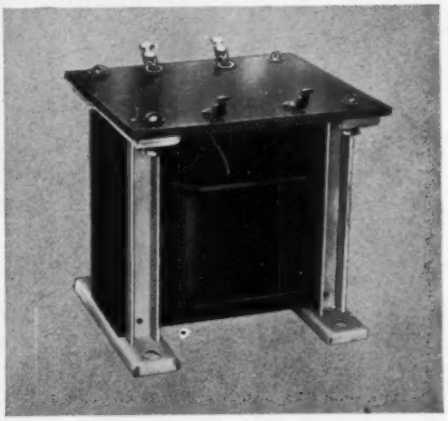

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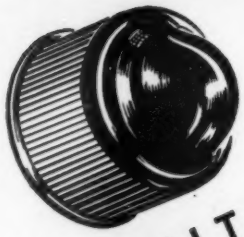

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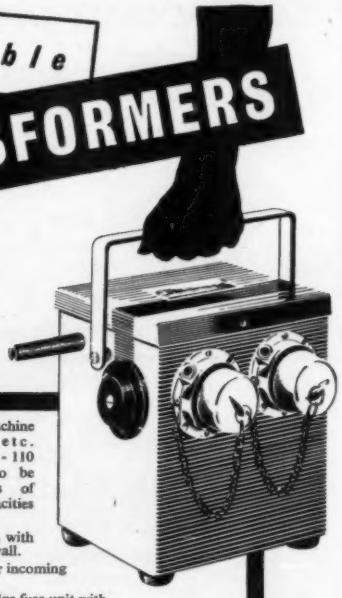

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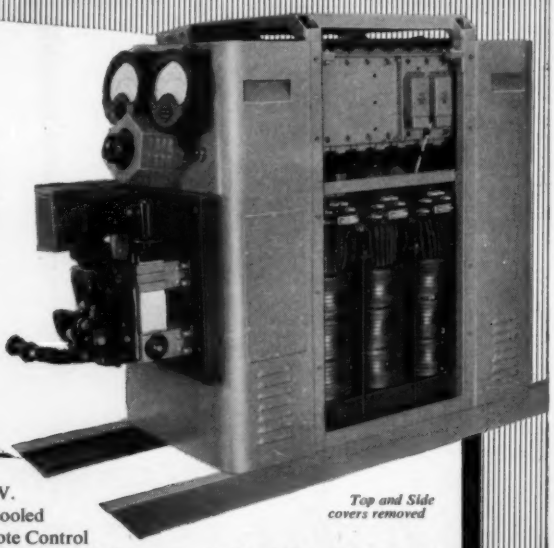

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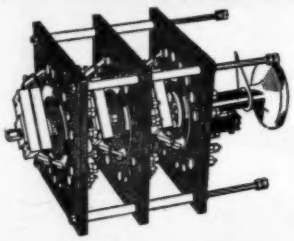

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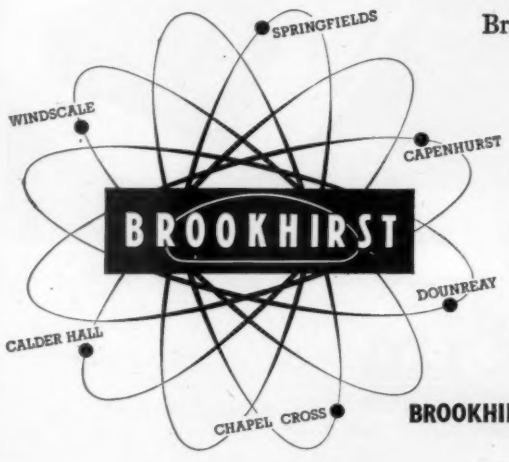

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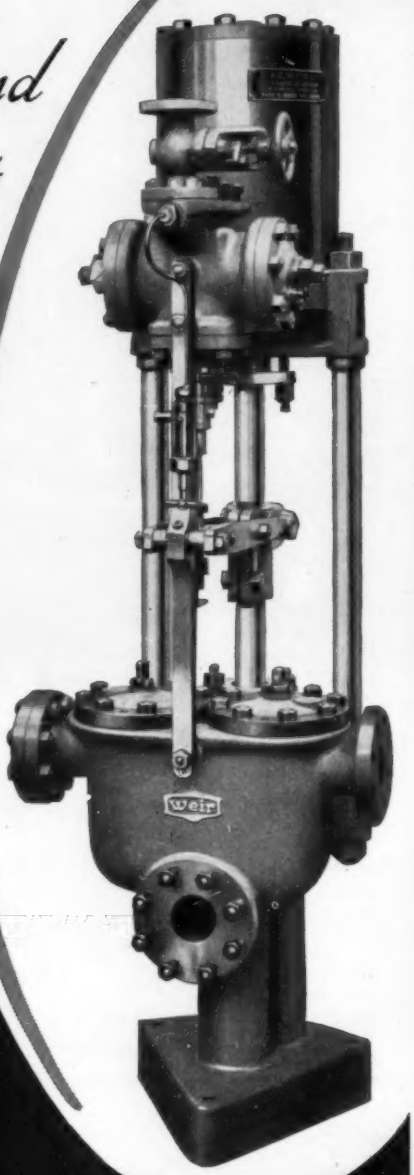

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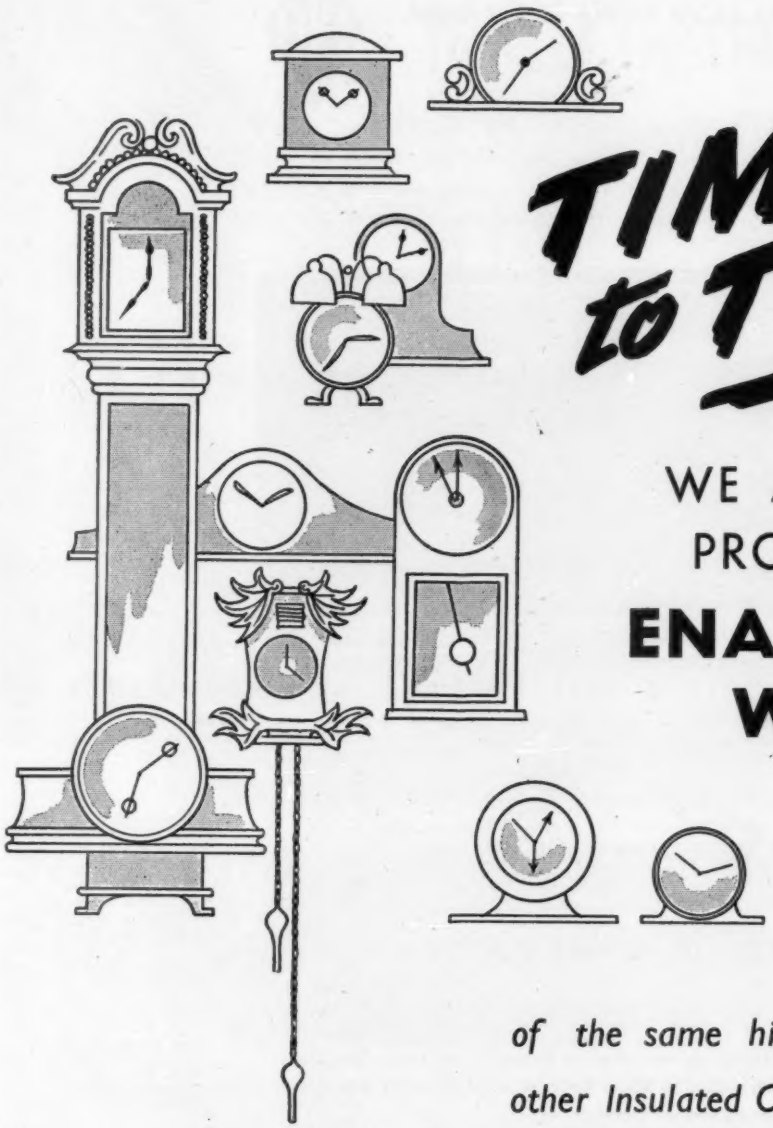

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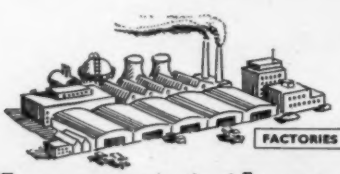
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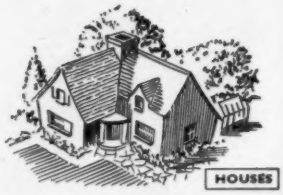
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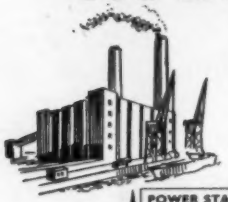
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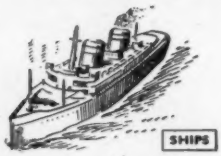
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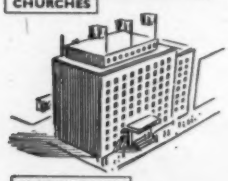
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FLEET—Gear channel, body and louvre of sheet steel, stove enamelled off-white. The louvre is specially designed to show only the transverse members and has "perspex" shields at each end to conceal the lamp holders.

WANDLE—Gear channel and body of sheet steel, stove enamelled off-white. The louvre is of polystyrene.

EMBER—Gear channel and body of sheet steel, stove enamelled off-white. The lower panel is of $\frac{1}{4}$" reeded clear "perspex".

The "THAMES" range of decorative fittings for fluorescent lamps has been designed to provide a range of 30 fittings from a small number of basic parts. Comprising five simple designs with six lamping possibilities in each; 2, 3 or 4 Lamps in 5 ft 80 watt or 4 ft 40 watt sizes. It will provide a fitting to suit the requirements of every interior from the point of view of both appearance and luminous output.

Designed by R. F. Steward, L.S.I.A. of Falks

FALKS
FALK STADELMANN & CO. LTD.

Lighting Engineers and Manufacturers of lighting fittings for all industrial, commercial and decorative purposes

91 FARRINGDON ROAD, LONDON, E.C.1 **Telephone: HOLborn 7654**
SHOWROOMS: 20/22 Mount Street, Park Lane, W.1 **Telephone: MAYfair 5671/2**
AP-17

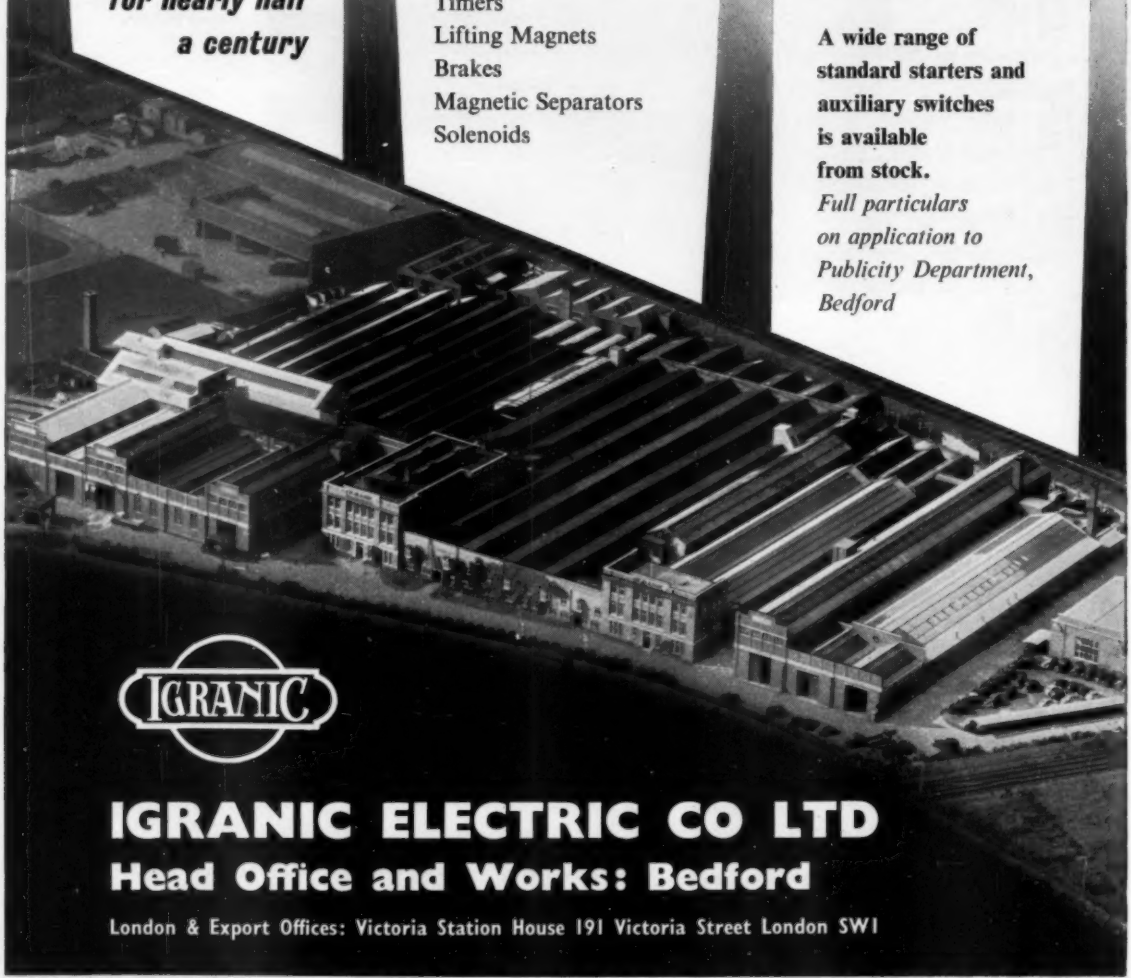
IGRANIC

the name which has meant dependability to users of Motor Control Gear for nearly half a century

A.C. & D.C. Starters, Contactors & Relays
Master Switches
Limit Switches
Pressure-Operated Switches
Liquid Level Control
Speed Responsive Switches
Timers
Lifting Magnets
Brakes
Magnetic Separators
Solenoids

Electro-Magnetic Clutches
Low Voltage Lighting Equipment & Step Down Transformers
Newspaper Conveyors
and **specially designed control gear for every industrial application.**

A wide range of standard starters and auxiliary switches is available from stock.
Full particulars on application to Publicity Department, Bedford



IGRANIC

IGRANIC ELECTRIC CO LTD

Head Office and Works: Bedford

London & Export Offices: Victoria Station House 191 Victoria Street London SW1

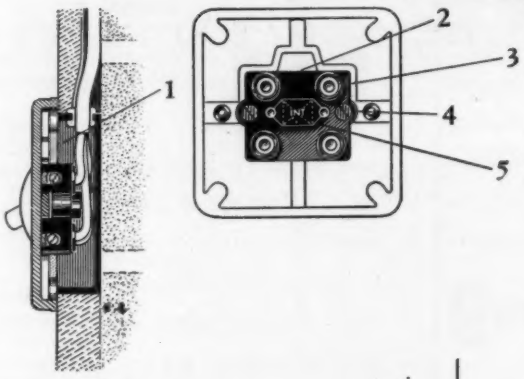
District Offices BIRMINGHAM BRISTOL CARDIFF EAST ANGLIA GLASGOW LEEDS MANCHESTER NEWCASTLE SHEFFIELD

A METAL INDUSTRIES GROUP COMPANY

P903 IG/80

a new high efficiency intermediate flush switch . . .

The "Lincoln" Intermediate switch is unique in that it embodies a highly efficient mechanism within a unit of extra-shallow proportions. Contacts are of beryllium copper with silver buttons and are moved to alternative positions by rollers of nylon material. Exhaustive tests have shown that the switch is conservatively rated at 5 amp. 250 volt AC—heavy load-making and breaking capacity is thus available in a unit which can be erected in a plaster-depth box. In size, appearance and performance, this new Intermediate switch is therefore in every way uniform with the popular "Lincoln" one- and two-way units with which it will be employed. Listed particulars will be found in Publication No. 1190, available on request.



1 Plaster Depth—can be erected in an extra-shallow box.

2 Sealed mechanism.

3 Large terminal screws readily accessible from the sides.

4 Contacts of beryllium copper with silver buttons.

5 Connection diagram moulded into base.

Crabtree

5 AMP. "LINCOLN" TYPE AC FLUSH SWITCHES

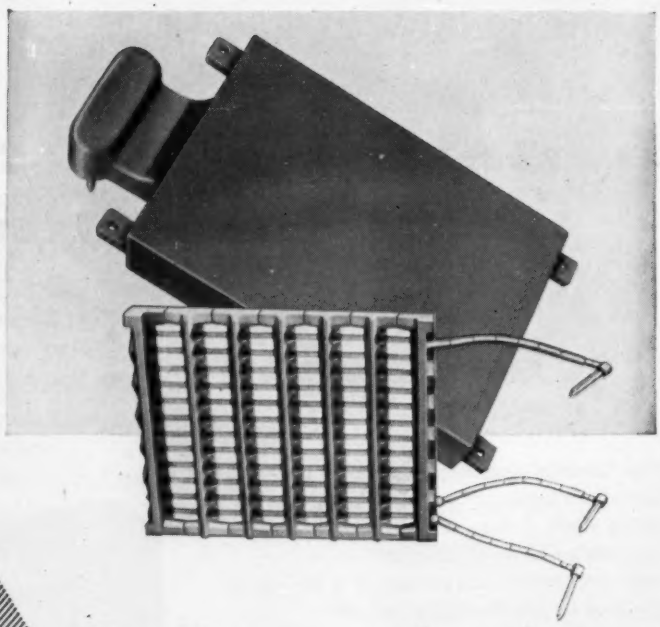
J. A. CRABTREE & CO. LTD.,
Lincoln Works, Walsall, Staffs.

c.766

GRILLER-BOILER PLATES FOR MODERN COOKERS

TO E.D.A. SPECIFICATION

High grade iron casting. British made ceramic insulators. Best quality 80/20 nickel chromium heating coils. Insulator assemblies available with or without insulated leads and terminal pins.



GENRISTO *The elements of Good Heating*

GENRISTO LTD., OSMASTON ST., NOTTINGHAM. Tel.: Nottm. 52148
Wholesale only

MERCURY SWITCHES

THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.
Since its inception in 1932, *this Company has concentrated solely on the production of Mercury Switches. It has thereby obtained the widest possible experience and expert knowledge of design, manufacture and application.*

THE MERCURY SWITCH MANUFACTURING CO. LTD.
WEST DRAYTON - MIDDX.

MS11

BLEECO **VERTICAL FLUORESCENT FITTINGS** *for* **STREET LIGHTING**

MODEL 3
Ornamental Unit for Group A Lighting in Town Centres and Similar Situations.

- Designs available for any combination of lanterns (2, 3 or 4).
- Each lantern accommodates four 2ft 40w tubes.
- The centre sphere is a spigot cap suitable for any diameter spigot and can be easily fitted to existing columns.

ALL FITTINGS COMPLETE WITH GEAR

BLEECO LTD.
35 Wellington Road
Brighton 7. *Phone: BRIGHTON 24661*

Straight Flush in Fractionals!

The Crompton Parkinson range of fractional horse-power motors covers practically every conceivable need up to 1½ h.p. The exact speed, the exact size, the right rating and mounting, the right type of enclosure — all just as the job dictates. Altogether hundreds of motors make up one of the biggest small-motor ranges in the country. And because today a great number of f.h.p. motors are fitted into confined spaces, where expert attention is hard to come by, Crompton Parkinson build for a detailed reliability that is out of the ordinary run. The proof is not far to seek. In their thousands, these motors are smoothly and quietly serving throughout the world of industry. Crompton Parkinson engineers are ready to advise you at any time on the right motor for the application.

Crompton Parkinson
LIMITED

Member of the Nuclear Power Consortium:
ATOMIC POWER CONSTRUCTIONS LTD.

MAKERS OF ELECTRIC MOTORS OF ALL KINDS · INSTRUMENTS
ALTERNATORS & GENERATORS · SWITCHGEAR
B.E.T. TRANSFORMERS · CABLES · CEILING FANS
LAMPS · LIGHTING EQUIPMENT · BATTERIES · STUD
WELDING EQUIPMENT · TRACTION EQUIPMENT

CROMPTON PARKINSON LTD., CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2

talking of covered conductors

. . . as you undoubtedly will from time to time, we would remind you that we specialise in them — the electrical, not the transport type, we hasten to add. Our range of Cotton, Paper, Silk, Rayon, Enamel & Silk, Enamel & Cotton covered wire and Paper or Cotton covered strip, covers every normal requirement and, where conditions are exceptional, we'll gladly help to solve the problem for you.

KEW

KENT BROS. ELECTRIC WIRE CO. & E. H. PHILLIPS LIMITED

KEW WORKS · BRACKNELL · BERKS
Telephone: BRACKNELL 881 (4 lines)
Telegrams: ENCOSIL, BRACKNELL, BERKSHIRE

RELAYS

P.O. TYPES MANUFACTURED TO YOUR SPECIFICATION

PROMPT DELIVERY

3000 TYPES

COILS up to 80,000Ω. CONTACTS up to 8 c/o's. Tropicalizing and impregnating to order. 600 and HIGH-SPEED TYPES also Supplied.

LARGE STOCKS OF KEYSWITCHES

THE KEYSWITCH CO.
ALL POST OFFICE EQUIPMENT
Enquiries to Sales Manager
126 KENSAL ROAD, LONDON, W.10
Telephone: LAD. 0666, 4640 *Grams: "Fonequipt", London, W.10*
Contractors to Home & Overseas Governments & H.M. Crown Agents

ACME *of Perfection*

GOLIATH & EDISON SCREW ELECTRIC LAMPHOLDERS
Patent Nos. 182194 & 24028

Tel.: EALing 6034-5

JULIUS SAX & CO. LTD.
24 COMMERCE ROAD
BRENTFORD · MIDDLESEX
Grams: Saxatile, Phone Brentford Hounslow

These lampholders are specified wherever a good holder is required.
GOLIATH holders can be relied upon to give years of trouble-free service.
EDISON SCREW holders possess many excellent Mechanical and Electrical features.

Folder with full details of Lampholders sent on request

ADVANCING with Aeroflex

HOPE'S PATENTS

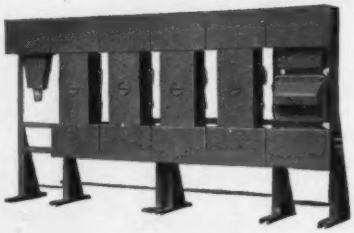
Photograph by courtesy of British Crepe Limited.

Fluvent Cubicle Type Switchboard recently supplied to British Crepe Ltd.

Fluvent Power Pillars—fully described in publication PP1, available on request.

ENERGY DISTRIBUTION FOR TODAY'S CONDITIONS

Energy Distribution for today's conditions demands fresh approaches. The examples illustrated are typical contributions by us to meet individual needs of widely different character.



Aeroflex Unit Type Switchboard, arranged so that any of the four outgoing circuits can be switched to either side of the busbars.

Parmiter Hope & Sugden Ltd

MANCHESTER 12

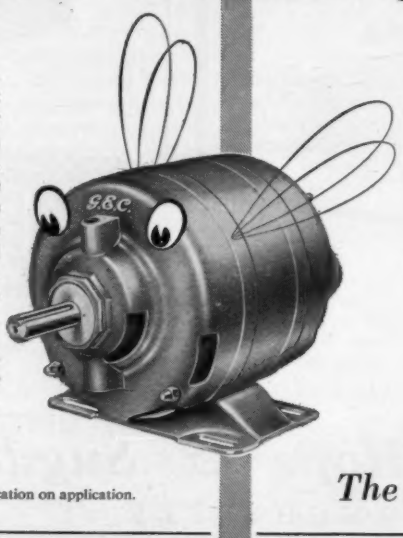
London: 34 Victoria Street, S.W.1. *Glasgow:* 5 Somerset Place, C.3 *Birmingham:* 39/41 Carrs Lane, 4

G.E.C.

Fractionals

put power where you want it

Power for many purposes. Power to drive your own plant efficiently, or to add further distinction to the equipment you make and sell. Power. As much (up to 1 h.p.) or as little as you need, in a wide range of mountings, but always with the reliability for which all G.E.C. engineering is famous. Power, from sturdy, dependable G.E.C. Fractionals. Most sizes and mountings are held in stock—that's another advantage of dealing with the G.E.C.



G.E.C. manufacture many types and sizes of fractional motors for light industrial and domestic drives—whether for your plant or products our engineers will always be pleased to help you choose the right motor for the job.

Fully detailed illustrated publication on application.

The Busy Bee from G.E.C.

THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE, KINGSWAY, LONDON: W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BELFAST

Electricity Department

STORES

TENDERS are invited for the supply of the undermentioned materials :—

Form No.

16. Vulcanised Bitumen & Paper Insulated Cables, C.I. Joint Boxes, Cleats and Ferrules.
22. Bare Hard Drawn High Conductivity Copper Conductors and P.V.C. Insulated Cables.
23. Street Lighting Fittings, Steel and Concrete Poles and Ancillary Equipment.
24. Transformer Kiosks with High and Low Tension Switchgear.
25. Overhead Line Equipment.
26. Mineral Insulated Copper Covered Cables and Terminating Accessories.
28. Bitite Strip, Prepared Tape and Rubber Tape for Joints, Joint Box Compounds and Refined Bitumen.
29. Rubber Insulated Cables and Flexible Cords.
30. Lamps.
31. Oilskin Coats, Tarpaulins, Rubber Jointing, etc.
32. Electric Water Heating Equipment and Hot Water Cylinder Insulating Jackets.
33. Nickel-Iron Switch Tripping Batteries and Charging Equipment.
34. 6,600-volt Ring Main and Switch Fuse Units.
36. Electrical Accessories and Kettle and Washboiler Elements.
37. Boiling Plates for Electric Cookers.
38. Medium Voltage H.R.C. Cartridge Fuse Links.
39. Imported Red Fir Wood Poles.

Note: Forms Nos. 29, 30 and 31 are in respect of materials which shall be supplied to any Department of the Corporation.

Forms of tender may be obtained from the Electricity Department, East Bridge Street, Belfast, on payment of the sum of Ten Shillings (non-returnable) for each form. Extra copies of the forms may be obtained at Five Shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation Conditions of Contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee," and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, 21st February, 1958.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
21st January, 1958. 2203

CLASSIFIED ADVERTISEMENTS ARE PREPAID

BOROUGH OF WIDNES

Tenders for Materials

THE Corporation invite tenders for the supply of the undermentioned material required in the Highways Department during the twelve months ending 31st March, 1959 :—

1. Portland Cement.
2. Broken Stone and Chippings.
3. Tar and Bitumen (Spraying Grades).
4. Castings.
5. Concrete Kerbs and Flags.
6. Tar and Bituminous Macadam.
7. Electrical Equipment.
8. Electric Lamps.
9. Gas Fittings and Mantles.

Forms of tender and specification may be obtained from F. A. J. Knight, Esq., A.M.I.C.E., M.I.Mun.E., Borough Engineer and Surveyor, Town Hall, Widnes.

Tenders in plain sealed envelopes endorsed "Tender for Materials" to be forwarded to reach the undersigned not later than the first post on Saturday, 22nd February, 1958.

The Council do not bind themselves to accept the lowest or any tender.

FRANK HOWARTH,
Town Clerk.

Town Hall, Widnes.
January, 1958. 2071

CITY OF SALFORD

TENDERS are invited for the supply and delivery of the following materials during the period 1st April, 1958, to 31st March, 1959.

(1) 25 ft. Concrete Columns.
(2) 15 ft. Concrete Columns.
(3) 140-watt Sodium Vapour Lanterns with ancillary equipment.
(4) 60-watt Sodium Vapour Lanterns with ancillary equipment.
(5) 100-150-watt Class "B" Lanterns.
(6) Synchronous Time Switches (Solar Dial).

Applications for forms of tender to be made to the Street Lighting Superintendent, 9, Frederick Road, Pendleton, Salford, 6. Tenders in plain sealed envelopes endorsed: "Tenders for Street Lighting Equipment," must be returned addressed to the Chairman, Street Lighting Committee, Town Hall, Salford, 3, not later than 5 p.m. on Tuesday, 4th February, 1958.

The Corporation does not bind itself to accept any or the lowest tender.

R. RIBBLESDALE THORNTON,
Town Clerk.

Town Hall,
Salford, 3. 2202

BOROUGH OF SOLIHULL

Street Lighting, Stratford Road

TENDERS are invited for the provision and installation in Trunk Road A.34 of 37 Lighting Units between Cranmore Boulevard and Hay Lane and 33 Lighting Units at Hockley Heath, including 25-ft. steel columns, 140-watt sodium lamps, lanterns and auxiliary gear.

Apply to Borough Engineer, Solihull, for particulars and official envelope in which to return tenders, which must be received by me at the Council House, Solihull, before 10 a.m. on 15th February, 1958. Returnable deposit of 2 guineas on specification, etc.

W. MAURICE MELL,
Town Clerk.

Council House,
Solihull. 2189

WARMINSTER URBAN DISTRICT COUNCIL

Supply and Erection of Group "A" Lighting Equipment

TENDERS are invited for the supply, delivery and erection of 104 Lanterns and fittings for 140-watt Sodium Discharge Lamps, together with tubular steel columns, brackets and other equipment.

Specification, bills of quantities and form of tender may be obtained from the Surveyor to the Council on deposit of £2, which will be returned upon receipt of a bona fide tender not subsequently withdrawn.

Tenders, in plain sealed envelopes endorsed "Tender, Street Lighting," must be delivered to me by 12 noon on Saturday, 22nd February, 1958.

The Council does not bind itself to accept the lowest or any tender.

W. H. EDWARDS,
Clerk of the Council.

Council Offices,
19, Portway,
Warminster, Wilts. 2200

CITY OF SALFORD

TENDERS are invited for the supply and delivery of the following materials during the period 1st April, 1958, to 31st March, 1959 :—

(1) Conduit and Fittings.
(2) Washleathers and Sponges.
(3) Gas Mantles.

Applications for forms of tender to be made to the Street Lighting Superintendent, 9, Frederick Road, Pendleton, Salford, 6. Tenders in plain sealed envelopes endorsed "Tenders for Conduit and Fittings, Washleathers and Sponges, and Gas Mantles," respectively, must be returned addressed to the Chairman, Purchasing Committee, Town Hall, Salford, 3, not later than 5 p.m. on Tuesday, 4th February, 1958.

The Corporation does not bind itself to accept any or the lowest tender.

R. RIBBLESDALE THORNTON,
Town Clerk.

Town Hall,
Salford, 3. 2201

PARISH OF ACKWORTH

TENDERS are invited for the supply, erection and putting into service of a system of Group A Lighting, consisting of precast concrete columns and 140-watt sodium vapour lamps on Trunk Road A.638 in the Parish of Ackworth.

Some lanterns will be of the totally enclosed type with a medium angle beam distribution of lighting, the remainder will be totally enclosed type lanterns with a full cut-off distribution.

Specification and tender form from Clerk, Ackworth Parish Council, 15, Wakefield Road, Ackworth, Yorks. Closing date 20th February, 1958. 2171

HORNSEY BOROUGH COUNCIL

School Lighting Alterations

THE Council invite tenders for improvements to the electric lighting installation at South Harringay Junior School, Mattison Road, London, N.8.

Particulars may be obtained from the Borough Engineer and Surveyor, Town Hall, London, N.8.

Tenders are to be received not later than noon, 19th February, 1958.

H. BEDALE,
Town Clerk.

2204

SITUATIONS VACANT

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

SECOND ASSISTANT ENGINEER (Mechanical),
GENERATION (Construction) DEPT.
(Vacancy No. 13/58/ER).

Preference will be given to applicants who hold a degree of Mechanical Engineering, are Corporate Members of the Institution of Mechanical Engineers, or possess equivalent qualifications. Some electrical training and experience will be a recommendation.

They should have some experience in the design and construction of turbo-alternators, boilers, coal and ash handling plant, high-pressure steam and water piping and other ancillary work.

Some knowledge of the preparation of specifications and estimates and a knowledge of thermo-dynamics and hydraulics will be an advantage.

Salary will be within Schedule B, Class AX/EX, Grade 4 (£1,145-£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5th February, 1958.

ASSISTANT ENGINEER (Instruments),
CASTLE DONINGTON
POWER STATION
(Vacancy No. 12/58/ER).

Applicants should have had sound training and wide experience in instrument making and/or repair. Preference will be given to candidates with knowledge of electronic and other modern forms of instrumentation and complex control systems as encountered in modern power stations or other large industrial organisations.

Salary will be in accordance with Class L, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5th February, 1958.

GENERAL ASSISTANT ENGINEER
(Chemist),
LINCOLN POWER STATION
(Vacancy No. 18/58/ER).

Candidates must have had a sound technical training and some previous experience in an industrial laboratory and should hold the Ordinary National Certificate in Chemistry.

The duties will include the routine analysis of coal, water and oil, but the post offers opportunities of gaining general experience in the chemical control of power station operation.

The salary will be within the range £540-£680 per annum in accordance with the National Joint Board Agreement.

Closing date for receipt of applications, 12th February, 1958.

These appointments will be pensionable under the terms of the Staff Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

22nd January, 1958. 2175

CALTEX SERVICES LIMITED

A SENIOR POWER ENGINEER is required for our London office to handle design problems connected with thermal power plants covering water treatment and steam and power generation with the associated distribution networks.

Candidates, under forty years of age, must have had several years of similar experience since qualifying and be prepared to visit overseas installations from time to time.

A salary commensurate with qualifications and experience can be offered.

Apply in writing with all particulars, and quoting "LON," to Caltex Services Limited, Caltex House, Knightsbridge Green, London, S.W.1.

2143

COUNTY BOROUGH OF BRIGHTON

WATERWORKS DEPARTMENT have two vacancies for :—

ASSISTANT ENGINEER, Grade A.P.T. III (£845-£1,025).

Applicants must hold University Degree in Civil or Electrical Engineering or be a corporate member of an approved professional institution.

One appointment is for an Assistant having experience of electrical plant, control gear and installation. Applicants for the second appointment should have good general waterworks experience.

Both appointments superannuable, terminable by one month's notice on either side and subject to medical examination.

50% of removal expenses refunded.

Application forms from the Waterworks Engineer, 12, Bond Street, Brighton, 1, to be returned to him suitably endorsed by 10th February, 1958.

W. O. DODD,
Town Clerk.

Town Hall, Brighton.
16th January, 1958. 2155

ENGLISH ELECTRIC

FUSEGEAR DIVISION

who manufacture a wide range of switchboards and distribution equipment incorporating H.R.C. fuses, have a limited number of vacancies for

SALES AND CONTRACTS ENGINEERS

at their Liverpool works. These positions are pensionable after a qualifying period and offer excellent opportunities for promotion and advancement to keen young engineers interested in making a career with the company.

Outside Representatives for both Home and Overseas Branches are appointed from the inside staff from time to time after completion of training, and applicants would be eligible for consideration after an initial period of not less than 3 years.

Qualifications required are H.N.C. or equivalent plus sound practical training and experience in (a) electricity supply or (b) industry.

Applications will also be considered from engineers who are at present in the final year of study for H.N.C.

Write giving full details to—

Dept. C.P.S.

336/7, Strand, London, W.C.2

quoting

Ref. ER.401L.

358

SOUTH EASTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Construction), Engineer-in-Chief's Department, Headquarters.

Salary in the range of £1,145 × £25 to £1,270/£1,375. N.J.B. Class AX/DX, Grade 4. Superannuable.

The duties attaching to this position require an experienced engineer, preferably a Corporate Member of the Institution of Electrical Engineers.

The person appointed will be required to assist in the design and construction of sub-stations up to 33 kV, and the preparation of specifications for plant and materials, including underground cable works and overhead lines. His duties will also embrace plant inspection and associated engineering problems.

Applications on forms from the Engineer-in-Chief, SEEBOARD, 10, Queen's Gardens, Hove, 3, Sussex, by 12th February, 1958.

GENERAL ASSISTANT ENGINEER, Sevenoaks and Reigate District.

Commencing salary £685 to £790 p.a. under N.J.B. agreement, Class F, Grades 11 to 9, according to qualifications, experience and ability. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems, preferably up to 33 kV. The position entails standby duties. The successful applicant will operate from District Office, Oxted, and his duties will cover any point within the district's area.

Applications, naming two referees, to H. F. Gill, District Manager, SEEBOARD, Electric House, West Hill, Oxted, by 12th February, 1958.

LADY DEMONSTRATOR, West Kent District.

Salary £500 × £20 to £600 p.a. plus London weighting under N.J.C. Grade 1. Superannuable. Applicants should possess a recognised diploma or certificate in domestic science, also E.A.W. Certificate. The successful applicant will be required to conduct lectures and demonstrations, advise consumers, and generally assist in service centres.

Applications on forms from P. S. Watson, M.I.E.E., West Kent District Manager, SEEBOARD, 270, High Street, Orpington, Kent, by 12th February, 1958.

A. L. BURNELL,
Secretary.

2211

EAST MIDLANDS ELECTRICITY BOARD

Senior Assistant Engineer (Meters), Nottingham Sub-Area

APPLICATIONS are invited for the position of SENIOR ASSISTANT ENGINEER (Meters) in the Nottingham Sub-Area.

The salary and conditions of the appointment will be in accordance with the National Joint Board Agreement, Class J, Grade 5 (£1,235-£1,325 per annum).

The person appointed will be responsible for the organisation, operation and control of a Class A Meter Testing Station dealing with the repairing, testing and maintenance of all types and classes of metering equipment. He will also be responsible for the installation and maintenance of high-voltage metering equipment and for the operation of an on-site prepayment meter service.

Applicants must be familiar with all types of A.C. single-phase and polyphase meters and trivector, kVA, integrating and telemetering schemes and equipment. An extensive knowledge of D.C. meter repair and testing and of mercury handling is essential. They should also be conversant with the testing of voltage and current transformers, the calibration and maintenance of recording and integrating instruments, and with the repair and maintenance of time switches, time clocks and ancillary equipment. Experience in testing power system relays would be an advantage.

Preference will be given to applicants having a technical qualification equivalent to the Higher National Certificate in Electrical Engineering.

Applications giving details of age, qualifications, experience and present appointment should be forwarded to the Manager, Nottingham Sub-Area, Talbot Street, Nottingham, to reach him within fourteen days of the issue of this advertisement. 2214

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Central Gloucestershire Sub-Area

GENERAL ASSISTANT DISTRICT ENGINEER (Gloucester District).

Applicants will be required to assist in all branches of distribution work, including construction, operation and maintenance of H.V./L.V. overhead and underground mains and substations. Technical qualifications desirable. Salary £685/£730 per annum (N.J.B. Grade F.11).

Apply by letter within 14 days stating age, experience, salary and present position, to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Road, Gloucester.

Worcester and District Sub-Area

THIRD ASSISTANT ENGINEER (Redditch and Bromsgrove District).

Applicants should have general experience of medium and high voltage overhead and underground distribution systems. Technical qualifications desirable. Salary £790/£835 per annum (N.J.B. Grade F.9).

Apply by letter within 14 days stating age, qualifications, experience, present position and salary, to Mr. R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

Birmingham and District Sub-Area

FOURTH ASSISTANT ENGINEER and GENERAL ASSISTANT ENGINEER (Technical and Planning Section).

To assist in the design of the H.V. and M.V. systems, analysis of loading conditions, preparation of specifications, layout of plant and equipment and technical investigations. Technical qualifications desirable. Salary, Fourth Assistant Engineer (N.J.B. Grades M.13/12) £885/£995 per annum. General Assistant Engineer (N.J.B. Grades M.18/14) £635/£880 per annum, according to qualifications and experience.

Apply by letter within 14 days stating age, experience, present position and salary, to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14, Dale End, Birmingham, 4.

A. STEPHENS,
Secretary.

2207

CITY OF SALISBURY, SOUTHERN RHODESIA

Vacancies for Assistant Shift Charge Engineers

APPLICATIONS are invited for the fixed establishment posts of ASSISTANT SHIFT CHARGE ENGINEERS on the grade £1,350 × £50 to £1,500 per annum, commencing salary at the minimum of the grade. No cost-of-living, shift or other allowances are payable.

Candidates must have completed an approved course of technical education in electrical and mechanical engineering, and the possession of appropriate technical qualifications will be an advantage. They must also have had considerable practical experience in the operation of steam power station plant in a responsible position, and experience of control room duties on an interconnected system will be a recommendation.

The appointments are subject to Council's service and leave regulations as amended from time to time, and successful applicants will be required to submit satisfactory medical certificates of fitness. They must also be able to comply with the requirements of the Immigration Authorities.

Applicants, who should be not more than 45 years of age, are required to submit full particulars of their technical education, qualifications (if any), training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Further particulars regarding the undertaking, conditions of service, contributions towards travelling and removal expenses, etc., may be obtained from Davis & Soper Ltd., to whom applications should be sent to arrive at their offices, 52 & 54, St. Mary Axe, London, E.C.3, not later than 14th February, 1958. 2054

ASSISTANT ENGINEER (ELECTRICAL)

required for London Office of CROWN AGENTS FOR OVERSEA GOVERNMENTS AND ADMINISTRATIONS. Pensionable post (two years' probation). Commencing salary between £805 p.a. at age 25 and £1,085 p.a. at age 34 or over in scale rising to £1,250 p.a. with prospects of promotion. Fully qualified officers over age 27 may be eligible for special increase of £75 after two years' service. Liberal leave. Five-day week.

Candidates, preferably between 25 and 35 years old, should have degree in electrical engineering or be Graduate or Corporate Members of I.E.E., should have served apprenticeship with electrical manufacturers, contractors or undertaking, and have had subsequent operation or design experience in either medium-sized thermal power stations, transmission and distribution systems or consumers' installations. Previous contract experience would be an advantage.

Duties will entail purchase of all types of electrical plant and equipment, preparation of detailed specifications, reports on problems connected with all types of electrical plant, and adjudication on tenders.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2A/42604/EF. 2187

A CHIEF PRODUCTION ENGINEER

is required by the

FIRST ELECTRIC CORPORATION OF JOHANNESBURG, SOUTH AFRICA.

THE successful applicant must have experience of production systems, production control and stock control relative to batch production methods, including the methods of detailing manufacturing information by drawing office.

It is essential also that he shall have had experience of fabrication, machining and assembly processes as related to the manufacture of electrical equipment.

The position offers good prospects to a man with initiative and drive and capable of assuming responsibility for the production planning and production control of main manufacturing departments (motors, switchgear, transformers and heating elements) and feeder departments (fabrication, press shop, machine shop, coil winding, copper and insulation), also the control of departmental stores.

A good starting salary is offered to the successful candidate and in addition pension and medical funds are available.

Apply in the first instance, giving full particulars, age, experience, etc., to EGE, Crown House, Aldwych, London, W.C.2.

2159

DESIGNER OF INDUSTRIAL LIGHTING EQUIPMENT

Applications for the above appointment are invited by

THE BENJAMIN ELECTRIC LIMITED.

Knowledge of fabricating techniques, finishes, lamps and control gear desirable, but initiative and ideas equally important.

The vacancy carries excellent prospects, with appropriate salary according to age, experience and qualifications. Staff luncheon room and pension scheme.

Apply Chief Technical Engineer, Brantwood Works, Tottenham, London, N.17.

177

COMMONWEALTH OF AUSTRALIA

Patent Office

Examiners of Patents

APPLICATIONS are invited for permanent positions as EXAMINERS OF PATENTS, GRADE I (£A1,043-£A1,493) in the Australian Patent Office to undertake the official scientific, technical and legal work in connection with Patent Applications.

Vacancies exist for Electronic (Computor, Television or Radar) Engineers or Scientists, Telephone Engineers, Organic Chemists and Mechanical Engineers.

Applicants must have an appropriate degree or diploma or have achieved a professional qualification, e.g., A.M.I.Mech.E., A.M.I.E.E. or A.R.I.C.

Commencing salary will depend on qualifications and experience and will not exceed £A1,313 per annum. Advancement beyond £A1,313 is dependent upon passing prescribed Patent Law examinations. Further opportunities exist for promotion to Grade 2, Grade 3 and Supervising Examiner (£A1,993). All salaries are in Australian currency and will commence from the date of embarkation.

All appointments are for Canberra. A limited number of new unfurnished houses are available on a rental basis for married appointees, and modern guest house accommodation will be provided for other successful applicants.

Assisted passages can be arranged by the Commonwealth Immigration Authorities in London for successful applicants and, if married, their wives and dependent children.

Application form and further particulars may be obtained from the Public Service Board Representative, Australia House, Strand, London, W.C.2.

Early application is advised. 2141

TELECOMMUNICATIONS

Transmission Development Engineers

THIS advertisement will interest men with experience in one or more of the following ranges :—

1. TRANSISTOR APPLICATIONS.
2. FILTER AND NETWORK DESIGN.
3. PULSE MODULATION.
4. V.H.F. AND MICROWAVE TECHNIQUES.
5. COMPONENT MINIATURISATION AND DESIGN.
6. TRANSMISSION EQUIPMENT PRACTICE.

The full resources of a world-famous company are being organised to develop existing and new techniques in these fields.

Vacancies exist for SENIOR ENGINEERS with honours degree qualifications to take up positions of responsibility on work of first-rate importance. JUNIOR ENGINEERS of H.N.C. standard with suitable training and experience will also be considered.

London facilities for specialised courses and further study.

These are "ground floor" vacancies with consequent opportunities for progress.

Candidates with appropriate experience in Nos. 3 or 4 may be nominated for certain vacancies at the company's research laboratories at Harlow New Town and also at the A.E.I. group research establishment at Aldermaston.

Applications, in confidence, will be assessed on previous experience, age and qualifications. Progressive salaries will be offered to suitable candidates, with participation in group pension and life assurance schemes.

Write with full details to—

Staff Officer, Ref. 744/100
SIEMENS EDISON SWAN LTD.
Woolwich Works, London, S.E.18

2072

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER
(Efficiency and Testing),
BATTERSEA POWER STATION
(Vacancy No. 58/54).

To carry out investigations on all matters concerning thermal efficiency and necessary tests on boilers, turbines, etc., also generally supervise preparation of station statistics. Salary Class L, Grade 9 = £1,115 p.a.

ASSISTANT ENGINEER
(Operation),
WOOLWICH POWER STATION
(Vacancy No. 58/55).

Candidates must be qualified engineers, experienced in power generation; will be required to take over duties of other Shift Engineers for relief purposes. Salary Class H, Grade 9 = £935 plus £88 10s. shift p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 10th February, 1958. 2172

DESIGNER AND DRAUGHTSMAN

THE RECTIFIER DIVISION of STANDARD TELEPHONES AND CABLES Limited, Edinburgh Way, Harlow, Essex, has vacancies for :—

TRANSFORMER DESIGN ENGINEER
(Ref. D.27)

For the design of transformers up to 50 kVA. O.N.C. (Electrical) minimum, with some experience on the design and manufacture of power transformers and associated gear preferred.

EQUIPMENT DRAUGHTSMAN
(Ref. D.5)

For the design of metal rectifier equipment, including transformers, metal frameworks and cubicles, component assembly, layouts, wiring diagrams and schematics.

Competitive salaries are paid.
Non-contributory pension scheme.
Accommodation available.
Household removal expenses reimbursed.

Please write, quoting appropriate reference number, to Mr. L. J. PLUMMER, PERSONNEL MANAGER, at the above address.

2190

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION

APPLICATIONS are invited for the position of—

CHIEF TECHNICAL OFFICER.

Applicants should possess a sound technical training, including University Degree in Science or Engineering and/or Corporate Membership of the Institution of Electrical Engineers. Extensive experience on the commercial side of electricity supply very desirable.

Candidates should have a general knowledge of the utilisation of electricity for all purposes in domestic and commercial premises, industry and farms. Advertising or publicity experience will be an advantage.

The salary will be on a scale £2,500-£2,700 per annum plus London allowance, the starting salary depending upon qualifications and experience.

Applications, stating qualifications and experience, age and present salary, should be addressed not later than 10th February to the Director and Secretary, British Electrical Development Association, 2, Savoy Hill, London, W.C.2. 2009

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment :—

GENERAL ASSISTANT ENGINEER,
LITTLE BARFORD
GENERATING STATION.

Salary Class G, within the range of Grades 15/13, £540 × £15 to £680 per annum plus 10% shift allowance, eventually rising to Class J, Grades 15/13, £635 × £15 to £785 per annum plus 10% shift allowance.

The commencing salary will depend upon the duties and responsibilities.

Duties of the above post include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a generating station, and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

Apply by 8th February, 1958, quoting ref. No. 2/8873, stating age, qualifications, experience and present position, to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts.

W. N. C. CLINCH,
Controller. 2192

AUTOMATIC TELEPHONE AND ELECTRIC COMPANY LIMITED

Physicist

AUTOMATIC TELEPHONE & ELECTRIC Co. Ltd., Liverpool, have a vacancy for a qualified PHYSICIST in their laboratories at their main works in Liverpool.

Candidates should possess graduate or equivalent qualifications with some knowledge of chemistry.

The successful candidate will be expected to carry out investigations on insulating materials, dielectric materials, plastics and other similar topics of applied industrial physics. The work is interesting and it is hoped that the candidate appointed will ultimately be able to qualify for a position of responsibility in the department. Some experience in the above field of work is desirable but not essential.

The post will be on permanent staff with generous contributory pension fund.

Full particulars of age, qualifications and experience may be sent to—

Personnel Manager
AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.
Strowger Works, Liverpool, 7

2157

AIR MINISTRY

WORKS Design Branch requires in London and Provinces ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in LONDON up to £1,015 per annum. Somewhat lower in PROVINCES. Starting pay dependent on age, qualifications and experience. Long-term possibilities with pensionable and promotion prospects. 5-day week, 3 weeks 3 days leave a year.

Liability for overseas service. Normally natural-born British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. Borough 104. 257

INSPECTING ENGINEER

to be based in Manchester, required by consulting engineers to cover all types of electrical control gear, including instrumentation as applied to generation and transmission systems.

Applicants should have had training with reputable manufacturers in this field and must possess technical qualifications to at least Graduate I.E.E. standard. Salary will be commensurate with the character of the appointment.

Application forms should be applied for in writing to Staff Appointments, Kennedy & Donkin, 813a, Wilmslow Road, Didsbury, Manchester, 20. 2145

MICHELIN TYRE CO. LTD.

Stoke-on-Trent

have progressive openings for

DESIGNER/DRAUGHTSMEN

with H.N.C. (electrical), or O.N.C. and now studying for H.N.C., for interesting work on motor applications, lighting schemes and general factory electrical services.

Good commencing salaries, related to qualifications and experience, are offered plus a contributory pension scheme, free life assurance and excellent welfare facilities.

ASSISTANCE WITH HOUSING WILL BE GIVEN IF REQUIRED.

Please write in confidence to :—

Mr. J. E. Glendenning

c/o above

quoting reference B1/ER.

1970

FERRANTI LIMITED

invites applications for the following vacancies in

METER ENGINEERING

1. RESEARCH AND DEVELOPMENT ENGINEERS with interest in the field of electrical measuring devices of high precision, with particular emphasis on integrating electricity meters. Vacancies exist for candidates WITH OR WITHOUT previous experience in this field. Applicants should preferably be under 35 years of age and possess qualifications of approximately graduate standard in electrical engineering or physics.

2. TECHNICAL ASSISTANTS capable of developing test gear and of taking responsibility. Candidates must hold at least an O.N.C. in Electrical Engineering. Vacancies exist for candidates WITH OR WITHOUT experience in the field.

Ferranti are foremost in the field of meter engineering and the vacancies offer excellent prospects and salaries.

The company has a staff pension scheme and an instalment assurance scheme for dependants.

Application forms may be obtained from T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote ref. M.D. (1) or (2).

2095

CENTRAL ELECTRICITY GENERATING BOARD

Nuclear Plant Design Engineer

APPLICATIONS are invited from suitably qualified candidates for the post of NUCLEAR PLANT DESIGN ENGINEER at Headquarters.

The successful candidate will head the nuclear side of the Engineering Department and will be responsible to the Chief Design and Construction Engineer. Duties will include discussions with industry during the evolution of designs, preparation of specifications, investigation of tenders, and responsibility for acceptance of contracts for the nuclear part of power stations. In addition they will include collaboration with the Research and Development Department and the United Kingdom Atomic Energy Authority and industry in their investigation of new techniques.

The salary will be subject to discussion, but relative to the qualifications and experience of the selected candidate will be of the order of £4,000 per year.

Letters of application stating age, qualifications, experience, present position and salary should be marked "Confidential" and forwarded to Mr. S. S. Scott, Chief Personnel Officer, Winsley Street, London, W.1, by 14th February, 1958. Reference E.R./28. 2139

INSTRUMENT ENGINEER

experienced in electronic and mechanical instrumentation required by

ENGLISH ELECTRIC, RUGBY.

Successful applicant will be required to plan, supervise installations, and, when necessary, service recording equipment in power station installations, and will act under the direction of the Chief Mechanical Erection Engineer.

The appointment offers considerable interest and opportunities for travel.

Write giving full details of previous experience to—

Dept. C.P.S.
336/7, Strand, London, W.C.2

quoting reference ER.1112A.

2144

ELECTRICAL ENGINEERS
DETAIL AND DESIGN DRAUGHTSMEN
PLANNING ENGINEERS

are required at our Motor Control Gear Works, Norwich.

Good working conditions. Contributory pension scheme. Assistance in obtaining housing. Attractive salary scales available for really good men.

Apply in confidence with details of age, qualifications, experience, etc., to :—

Personnel Officer
LAURENCE, SCOTT & ELECTROMOTORS LTD.
Gothic Works
Norwich

2126

SUNDERLAND EDUCATION COMMITTEE

Technical College

APPLICATIONS are invited for the post of LECTURER in the Electrical Engineering Department. Candidates must have a degree in electrical engineering, industrial experience, and be capable of teaching electronics and/or servo-mechanisms to degree standard. The work of the department includes courses for the B.Sc. degrees of Durham and London Universities, the Higher National Diploma and the Higher National Certificate. Duties to commence as soon as possible.

Salary in accordance with the Burnham Technical Scale for Lecturers, £1,200 × £30 to £1,350, with increments for approved industrial experience.

Forms of application and further particulars may be obtained from the Registrar, The Technical College, Sunderland, Co. Durham, and should be returned to the undersigned within two weeks of the appearance of this advertisement.

Canvassing will be a disqualification.

W. THOMPSON,
Director of Education.

Education Offices,
15, John Street,
Sunderland. 2176

AUTOMOTIVE ELECTRICIAN

required
for immediate employment in oilfields in
VENEZUELA.

Would be required to take charge of electrical repair shops of Vehicle Overhaul Department, also as technical adviser to Transport Department on all auto and marine electrical matters.

Candidate must be primarily a practical man, able to work without supervision, and competent to write a good technical report. A minimum academic qualification of National Certificate necessary. Essential to have at least six years as a supervisor or foreman in charge of auto electricians on electrical repair work and be familiar with the electrical side of British and U.S. light and heavy vehicle and earth moving equipment, cranes and test gear.

Knowledge of marine electrical work and fuel injection equipment useful. Generous overseas U.S. dollar salary. Tours two and three years with local leave and paid home leave end of each tour. Single or married man considered. Approximate age 30/35 years. All travelling expenses paid for interviews.

Please write giving full details experience, qualifications, age, etc. to—

Box Z.E.68
DEACONS ADVERTISING
36, Leadenhall Street, London, E.C.3
2194

TECHNICAL SALES ENGINEER

FOR

NORTH EAST ENGLAND AND SCOTLAND.

To be based in LEEDS and represent a Division of an internationally established company manufacturing electrical components and equipments

Age 25 to 40 years. Electrical training, commercial experience and a general knowledge of electrical engineering industries in the North is essential. O.N.C. (Elec.) or higher qualification and/or knowledge of metal rectifiers is an advantage.

Straight salary up to £1,000 per annum, according to qualifications, etc., plus expenses. Car provided.

Interview will be held in LEEDS.

Please write, quoting ref. D.1, and stating relevant particulars to—Box 4D L.5433, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2.

2206

YORKSHIRE SWITCHGEAR & ENGINEERING CO. LTD.

Meanwood, Leeds, 6

invites applications for the following posts in its expanding technical organisation :—

1. SENIOR TEST ENGINEER.

Applicants should have minimum qualification of H.N.C. in Electrical Engineering. The work is interesting and varied, covering the field of insulation research, climatic protection and fundamental circuit breaker research, in addition to routine switchgear testing. The company has well-equipped laboratory facilities which embody the latest measuring techniques.

2. JUNIOR ENGINEERS.

A number of junior engineers are required for the other technical departments, including sales estimating, contract engineering and design. Minimum qualification for these positions would normally be O.N.C. in Electrical Engineering, but applicants will be given individual consideration.

The company operates a non-contributory pension scheme and the factory is pleasantly located.

Applications, which will be guaranteed strict confidence, should state age, present position and salary required, and be marked for the attention of the Managing Director. 2055

ELECTRICAL/MECHANICAL ENGINEERING DESIGNER

THIS senior position with Merseyside company of medium size calls for rotating machine design ability, both electrical and mechanical, of a high order. Experience on control gear and systems, including electronics, is also desirable.

The company, associated with a large group, expects to pay an attractive four-figure salary to a Designer who is looking for a challenging position in which he can both develop and extend the Company's existing range of products. These products are of small/medium size and special-purpose type.

First class qualifications are necessary; adequate benefits are available. Applications, which should include age and salary indication, will be treated most confidentially.

Box 2222.

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

GOOLE DISTRICT

SECOND ASSISTANT DISTRICT ENGINEER (Selby).

Applicants should have had sound practical experience in the operation, maintenance, planning and construction of H.V. and L.V. underground and overhead lines and substations in an extensive rural area.

Preference will be given to candidates who have the Higher National Certificate in Electrical Engineering or possess equivalent qualifications.

The successful candidate will be required to undertake standby duty and to reside in Selby.

Salary N.J.B. Class E, Grade 7, £835/£15/£880 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 14th February, 1958. 2218

J. A. CRABTREE & CO. LTD.
WALSALL

require DESIGN ENGINEERS for Control Gear and Miniature Circuit Breaker Development. Applicants should have experience in one of the above fields and be capable of initiating all detail development without supervision. It is desirable that candidates hold at least H.N.C. Electrical.

Applications, stating age, experience and salary required, should be addressed to the Technical Director. 2012

Situations Vacant (continued)

ADEN

Mains Engineer, Electricity Department

to be responsible for the Distribution Branch of the Department, involving planning constructions, maintenance and operation of the L.V. and H.V. systems, including substations, records and control of transport.

Appointment is either on agreement with prospect of admission to the pensionable establishment in the salary range £1,032-£1,605, or on contract, in which case a gratuity of £37 10s. for each three months' satisfactory service is payable. Furnished quarters with refrigerator at low rental. Free medical attention for officer and family, and free passages for officer, wife, and four children under 18. Allowance for education of children outside Aden. Generous leave.

Candidates, under 50 years of age, must have passed or be exempt from the examination of the Institution of Electrical Engineers, and must have had considerable experience on the distribution side of electricity supply undertakings up to and including 33 kV.

Write Director of Recruitment, Colonial Office, stating age, qualifications and experience. Quote BCD.145/2/02. 2140

EAST MIDLANDS ELECTRICITY BOARD

Third Assistant Engineer (Meters)
Lincolnshire Sub-Area

APPLICATIONS are invited for the appointment of a THIRD ASSISTANT ENGINEER (Meters) at the Headquarters of the Lincolnshire Sub-Area.

The salary and conditions of appointment will be in accordance with the National Joint Board Agreement, Class J, Grade 10 (£885-£930 per annum).

The duties of the post consist of the commissioning and periodic testing on site of C/T operated and H.V. metering equipments in the Sub-Area and dealing with queries on large consumers' metering.

Ability to drive a motor vehicle is essential and the person appointed must possess a current driving licence.

Applications stating age, qualifications, experience and present position, should be forwarded to The Manager, Lincolnshire Sub-Area, North House, Grantham, to reach him within fourteen days of the issue of this advertisement. 2212

WHOLESALE FITTINGS CO. LTD.

Electrical and Radio Distributors,
have the following vacancies :—

SHOWROOM ASSISTANTS.

Young men with experience of lighting fittings and domestic appliances.

TRADE COUNTER ASSISTANTS

with experience of electrical accessories and knowledge of current prices.

PRICING CLERKS

with experience in all types of electrical commodities.

Progressive vacancies in other departments for young men with experience of electrical wholesaling. Applications invited in confidence.

Apply in writing stating age and experience to

Staff Manager
WHOLESALE FITTINGS CO. LTD.
46/52, Commercial Street, London, E.1
2158

DEPUTY SITE ENGINEER

APPLICATIONS are invited for the position of DEPUTY TO THE SITE ENGINEER ENGAGED ON A LARGE CONSTRUCTION PROGRAMME. Preference will be given to candidates who have wide experience in turbine and modern power station construction. Salary will be commensurate with the responsibility.

Applicants should write stating age, qualifications, experience, present position and salary to—Box 2156.

BRITISH STANDARDS INSTITUTION

Electrical Engineers

THE B.S.I. invites applications from electrical engineers to join the technical staff of the Institution. The technical staff are responsible for the work of the Institution in the preparation of British Standards in co-operation with the various sections of industry and are required to plan and progress the work.

Applicants should have a university degree or equivalent professional qualification in electrical engineering.

There are three grades of appointment, with an overall salary range of £750 to £2,000; new entrants will only be accepted in the lowest grade, the commencing salary being dependent on individual qualifications and experience. The posts are pensionable.

Apply to the Establishment Officer, B.S.I., 2, Park Street, London, W.1. 2216

FRANCIS SHAW & CO. LIMITED

have vacancies for

SENIOR ELECTRICAL DRAUGHTSMEN

First-class men required for interesting work on Rubber and Plastics Machinery. Applicants must be conversant with motor control diagrams and have had a comprehensive engineering apprenticeship, including drawing office experience.

Salary will be commensurate with responsibility and a generous non-contributory pension scheme is in operation.

Apply in writing, giving fullest details, which will be treated in confidence, to the Secretary, Francis Shaw & Co. Limited, Corbett Street, Manchester, 11.

2142

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

READING District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Grade 11, Class H (£790-£835 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and to undertake standby duties if required. Suitable technical qualifications and field planning experience are necessary.

The successful candidate will be required to contribute to the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Rd., Newbury, and returned to him in envelopes suitably endorsed not later than 10th February, 1958. 2217

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

FOURTH ASSISTANT ENGINEER, SWINDON AREA.
TECHNICAL DEPARTMENT
(S/13.966).

Applicants should have experience of electrical engineering in relation to protective gear including testing, and knowledge of modern switchgear practice is desirable. Applicants should possess O.N.C. or equivalent, and be studying for H.N.C.

Salary N.J.B. Class AX/CX, Grade 8, £710-£885.

Special application forms, obtainable only from P. D. A. Oliver, Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 12th February, 1958. 2209

ELECTRICAL DRAUGHTSMAN

wanted with intimate knowledge contactors, relays and control circuits generally. Interest in electronics and/or heating practices an advantage. Required to work on new project and application problems for Technical Director.

ELCONTROL LTD.
Wilbury Way, Hitchin, Herts
2146

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION

Industrial Electric Heating Engineer

APPLICATIONS are invited for the appointment of an engineer with general knowledge of the utilisation of electricity for heat treatment and process heating.

Candidates should have experience of various types of industrial electric heating equipment, including furnaces, resistance heaters and high frequency heaters, and of their practical application in factories and works. The possession of a University Degree in Science or Engineering will be an advantage, ability to read French and/or German desirable. Salary within range £1,435/£1,560, plus £50 London allowance, with starting point according to experience and qualifications. Pension scheme available.

Applications, stating age, qualifications and experience and salary required, should be addressed, by 21st February, 1958, to the Director and Secretary, British Electrical Development Association, 2, Savoy Hill, London, W.C.2. 2220

MIDDLESEX COUNTY COUNCIL

Education Committee

SOUTHALL TECHNICAL COLLEGE,
Beaconsfield Road, Southall, Middlesex

REQUIRED for 1st April, 1958:—
ASSISTANT GRADE B to teach ELECTRICAL ENGINEERING subjects in Ordinary and Higher National Certificate courses.

Good industrial experience, together with previous teaching experience or training, are desirable. Preference will be given to those having a degree or its equivalent.

Salary in accordance with the Burnham (Technical) Report, 1956, i.e. £650 × £25 to £1,025, plus London allowance and other additions for previous experience as appropriate.

Application forms and further details (stamped addressed foolscap envelope) from the Principal, to whom completed forms should be returned within 14 days of the appearance of this advertisement.

C. E. GURR, M.Sc., Ph.D.,
Secretary to the Education Committee.
2221

EAST MIDLANDS ELECTRICITY BOARD

Fourth Assistant Engineer (Meters),
Northamptonshire Sub-Area

APPLICATIONS are invited for appointment as FOURTH ASSISTANT ENGINEER (Meters) at the Sub-Area Headquarters, Northampton.

Applicants should have suitable technical qualifications with experience of instrument standardisation and calibration of polyphase meters, indicators and recorders. Experience in testing power system relays would be an advantage.

The salary and conditions of employment will be in accordance with the National Joint Board Agreement, Class K, Grade 13 (£790-£835 per annum).

Applications stating age, qualifications, education, experience and details of present position should be forwarded to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, to reach him within fourteen days of the date of this advertisement. 2213

POWER RECTIFIERS

A LARGE manufacturing firm in the Midlands requires an engineer to assist in development and design of high-power rectifier equipments. The department handles rectifiers of all modern types and for all kinds of applications, offering scope for exceptionally wide experience and interest, with good salary and prospects.

Previous rectifier experience not necessary, but an electrical or mechanical degree or approximate equivalent, and some practical experience, are desirable. Very good residential district, with excellent educational facilities of all kinds.

Apply with full details to—Box 1978.

BIRKENHEAD EDUCATION COMMITTEE

Birkenhead Technical College

Principal: C. V. Vinten Fenton, M.Sc., A.M.I.Mech.E., A.M.I.E.E.

APPLICATIONS are invited for the following appointment to the full-time staff:—

LECTURER in Electrical Engineering with Mathematics to H.N.C. standard for Electrical Engineering Department.

Salary in accordance with the Burnham Technical Report, 1956.

Further particulars and forms of application may be obtained from the undersigned, to whom completed applications should be returned by 10th February, 1958.

H. GLYN WILKINSON,
Director of Education.

63, Hamilton Square,
Birkenhead. 2193

ELECTRICAL ENGINEERS

required for Technical Estimating Department of Automatic Motor Control Gear Makers in West Midlands, following further expansion.

The work comprises the initial engineering of control schemes, the calculation of their cost, and the preparation of tenders.

A pension scheme is in operation and assistance towards removal expenses will be paid in approved cases.

Apply in confidence, stating age, experience and salary required, to—Box 362.

EASTERN ELECTRICITY BOARD

Northmet Sub-Area
11/58.R.

THIRD ASSISTANT ENGINEER, BARNET DISTRICT (Ref. 771). Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class F, Grade 9 (£790-£835) plus London allowance.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Apply by letter to L. F. G. Baker, Manager, Eastern Electricity Board, 7c, High Street, Barnet, by 10th February, 1958. 2205

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

STATION SHIFT CONTROL ENGINEER required at Portishead B Power Station.

Superannuation scheme. Salary N.J.B. Class K, Grade 10, £935-£995 per annum (plus 10% shift allowance).

Candidates should possess good technical qualifications and have had training and experience in the control and operation of steam generating plant and main switchgear in a modern power station.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 15th February, 1958. 2210

LONDON COUNTY COUNCIL

Wandsworth Technical College

REQUIRED as soon as possible, ASSISTANTS GRADE B for Electrical Engineering subjects to O.N.C. standard. Ability to teach Electrical Installations or Telecommunications subjects an advantage. Graduate or equivalent qualifications, industrial and teaching experience desirable.

Burnham F.E. scales, Grade B, £650 × £25 to £1,025 plus London allowance, and additions for training and qualifications. Increments within the scale for experience.

Application forms from Secretary at College, Wandsworth High Street, London, S.W.18, to be returned by 14th February, 1958. (122) 2178

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER is required at Walsall and Birchills Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade J9, £935-£995 per annum plus 10% for shift duties.

Applicants should have received a sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear. Appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 727MD, on Form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 12th February, 1958. 2173

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

STATION SHIFT CONTROL ENGINEER is required at Nechells "B" Power Station, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade J.10, £885 to £930 per annum plus 10% for shift duties.

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 728MD, on Form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 11th February, 1958. 2174

CHIEF DESIGNER

WANTED by an important firm manufacturing switchgear, a CHIEF DESIGNER, or a Designer of sufficient calibre who thinks, with sufficient reason, that he could attain this position within the next year or so. Must have experience of the latest practice in oil and air break high-voltage circuit breakers and ancillary gear, be capable of conducting and analysing short circuit tests, have creative imagination and the ability to profit from his failures.

Remuneration according to qualifications, but in no case mean.

North Midlands.

Box 2056.

NORTH EASTERN ELECTRICITY BOARD

Tees Sub-Area

APPLICATIONS are invited for the appointment of THIRD ASSISTANT COMMERCIAL ENGINEER, Sub-Area Headquarters, Thornaby-on-Tees.

Salary Schedule A, Class K, Grade 10, £935/£995. N.J.B. conditions of service.

Applications, stating age, qualifications and experience, to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 2219

SALES REPRESENTATIVES

APPLICATIONS are invited from SALES REPRESENTATIVES of proved ability, who have a sound engineering knowledge of power transformers and have sales contacts with the C.E.A. and Area Boards. Experience in the preparation of tenders would be an advantage.

The company operates a pension scheme and would give assistance regarding accommodation, etc.

Applicants should state qualifications, experience and salary required.

THE LINDLEY THOMPSON TRANSFORMER & SERVICE CO. LTD.
St. Mary's Road, Langley, Slough, Bucks.
2127

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a position as ASSISTANT SHIFT CHARGE ENGINEER at Braehead Generating Station. Applicants should have had experience in a modern generating station and preferably possess a Higher National Certificate in Electrical or Mechanical Engineering.

Salary N.J.B. Class J, Grade 9, £935/£995 per annum plus shift allowance of 10%.

Forms of application may be obtained from the Secretary, South of Scotland Electricity Board, 168, Broomhill Drive, Glasgow, W.1, and returned not later than Friday, 14th February, 1958. 2177

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

THIRD ASSISTANT ENGINEER required for Transmission Section of the Chief Electrical and Mechanical Engineer's Department. Candidates should have experience of 132-kV substation and line construction and contract work.

Salary commencing at a point within the range £1,055-£1,250 (N.J.B. Schedule B, Class AX/CX, Grade 5) depending on experience and qualifications. Superannuation scheme.

Application form, obtainable from the Secretary, 16, Rothesay Terrace, Edinburgh, 3, should be returned within 21 days from the publication of this notice. 2191

EAST MIDLANDS ELECTRICITY BOARD

Electrician (Telephone), Northamptonshire Sub-Area

ELECTRICIAN (Telephone) required for maintenance of automatic telephones and remote control equipment, preferably with experience of radio or electronics. National Joint Industrial Council conditions and wage rates, at present 4s. 7½d. per hour for a 44-hour, 5-day week.

Apply by letter stating age, qualifications and giving full details of experience to the Secretary, Northamptonshire Sub-Area, 25, Bridge Street, Northampton. 2215

THE UNIVERSITY OF LIVERPOOL

APPLICATIONS are invited for the post of ASSISTANT SECRETARY to the University Appointments Board at an initial salary within the scale £1,000 × £50 to £1,400 per annum, according to qualifications and experience. Applicants should be graduates of a British university, preferably in Science or Engineering, with some experience of industry.

Applications, stating age, academic qualifications and experience, together with the names of three referees, should be received not later than 15th February, 1958, by the Registrar, from whom further particulars of the conditions of appointment may be obtained. 2138

ARMATURE winder for all types A.C. and D.C. repair work. Good rate, bonus, five-day week, overtime, etc.—Lewis Electric Motors Ltd., Moor Works, Blackamoor Lane, Maidenhead, Berks. 142

ARMATURE winders wanted for repair shop. Apply—Minta, Hartley Road, Luton. 9244

ARON ELECTRICITY METER Ltd. invite applications for the position of indoor sales engineer. Applicants are required to have a sound technical background, preferably applied to electricity meters and electronic equipment. Superannuation scheme in operation. Applicants should supply full details of experience, age and salary required, and replies, which will be treated in the strictest confidence, should be addressed to the General Sales Manager, Aron Electricity Meter Limited, 72-82, Salusbury Road, London, N.W.6. 1888

ASSISTANT for sales office, sound knowledge electrical accessory trade, knowledge export an advantage. Full details in writing, age, experience and salary to—S. O. Bowker Ltd., 19/21, Warstone Lane, Birmingham. 2147

BRANCH manager required by electrical wholesaler in South of England. Must have experience in similar position and desire to develop flourishing business. Car provided. Salary and commission according to experience. Superannuation scheme.—Box 2080.

***Situations Vacant** (continued)*

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel Street, Manchester, 4. Electrical surveyors required for various districts in Great Britain. Permanent positions carrying progressive salary scale £735 to £1,060 and non-contributory pension. Candidates, age 26 to 32, preferably with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply in own handwriting, stating age, qualifications and experience. 2180

CABLE and lighting installation. Experienced engineers and draughtsmen reqd. to cover important contracts in U.K. and overseas. Engineers for planning of telecommunications network or supervision of subsequent installation and for power cable installations in generating stations and industrial plant. Draughtsmen for preparation of cable layouts on all these varied projects. Good practical and technical background desirable. Applicants must be in good health and willing to travel as necessary. Age limit 45 unless with previous experience abroad. Permanent pensionable staff appointments. Write with full details in confidence, stating age, experience and salary expected in U.K. to—Staff Officer, Ref. 744/1, Siemens Edison Swan Ltd., Woolwich, London, S.E.18. 2160

CABLE works manager required for overseas factory of leading British company. Fully experienced in al branches of cable manufacture. Write stating age and full particulars to—Box Z.684, c/o Streets, 110, Old Broad Street, London, E.C.2. 2161

CAPABLE electrical designer/draughtsman required, age not less than 25 years; some mechanical experience an advantage for development on electrical application to machine tools. 5-day week, staff pension scheme. Write stating age, full experience and technical qualifications to—Employment Office, Alfred Herbert Ltd., Coventry. 2162

CIRCUIT design draughtsmen required by company manufacturing industrial control equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 273

CONTRACTS engineer required for interesting work on specialised electrical equipment. Good prospects with a small firm in N.W. London for a young man with experience in automatic control gear.—Box 2163.

DESIGNER/draughtsman for design and development of special low tension switch and fusegear. Good salary and excellent prospects in an expanding company.—Peppers of Woking Ltd., Stanhope Road, Camberley, Surrey. 2232

DEWHURST & PARTNER Ltd. require technical estimator for preparing tenders in their estimating engineering department. Applicant must have good electrical engineering background and have basic knowledge of motor control equipment and its applications. The position is a senior one, and housing assistance will be given to successful applicant if necessary. Canteen facilities, pension scheme. Write giving age, experience, etc., to — Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middlesex. 274

DRAUGHTSMAN designer, also a junior, sought by electrical contractors (London, W.C.2) for first-class installations. The benefits are work on all types of buildings, stability and scope for individuality with old-established firm, attractive prospects, good salary and permanency for right men. Write in confidence stating age, experience and salary expected.—Box 2017.

DRAUGHTSMAN required in expanding design and development section of switchgear manufacturers. Previous switchgear experience and a good technical background necessary. A.E.S.D. rates of pay and bonus scheme, non-contributory superannuation scheme also in operation. Assistance with housing available if necessary to successful applicant. The company is situated in pleasant country surroundings within six miles of the Devon coast. Write, stating experience, age, etc., to—Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 1920

EAST African installation contractors require supervising engineer, preferably experience abroad, aged 30/35, for general work.—Box 1991

DRAUGHTSMAN wanted. Electrical experience an advantage. Opportunity for ambitious man in Westminster office. Write age, experience and salary required.—Box 2165.

DRAUGHTSMAN wanted for mechanical engineering work and pressure vessel design. Good prospects, superannuation scheme and pleasant working conditions.—Bastian & Allen, Ferndale Terrace, Harrow. 2164

ELECTRICAL contractors (Manchester area) require an experienced engineer to handle contracts from enquiry to final accounts. Reply giving full details, salary, etc.—Box 2181.

ELECTRICAL engineer, graduate, preferably of honours degree standard, required by the research laboratories of British Insulated Callender's Cables Ltd., Shepherds Bush, London, W.12. The work involves research and development on dielectrics and capacitors. Experience in vacuum-metallising or ceramics would be an advantage. Five-day week. Pension fund. Applications giving details of age, qualifications and experience should be made to the Personnel Officer, 38, Wood Lane, London, W.12. 2042

ELECTRICAL engineer or physicist interested in problems associated with design of cables and accessories required for work on detailed problems concerned with electrical field plotting. Age 21/30. Degree standard. Good pay and prospects for man with initiative. Apply to—Staff Officer, B.I.C.C. Ltd., Belvedere Kent. 2167

ELECTRICAL engineer required to assist in the commercial and technical development of electric control of pipeline valves. An excellent opening in a very interesting and rapidly developing field, offering full scope for initiative and opportunities later for travel at home and abroad. Familiarity with control gear or relay circuits an advantage. Preferred age range 24-30, commencing salary £650-£950 depending on qualifications and experience. Apply to—Rotork Engineering Co. Ltd., Widcombe Manor, Bath, Som. 2168

ELECTRICAL engineering assistant reqd. with experience of general installation works and subsequent maintenance. H.N.C. (elec.) desirable. Pensionable position. Salary up to £860 p.a. Applicn. form from Chief Engineer (58/2), L.C.C., County Hall, London, S.E.1. (18) 2179

ELECTRICAL wholesalers London require order clerk for customers' telephone orders. Familiar switchgear and installation materials. —Phone Gerrard 4012 (Mr. Welfare). 2195

ELECTRICAL wholesalers require sales assistants for branches in London area. Good wages and bright prospects for ambitious young men. Write in strict confidence giving full details, age, experience, salary required, etc., to—Box 2182.

ELECTRICIAN/electrical mechanic, first-class experience installation work, required by large electrical concern. 12 months' service overseas. Excellent opportunity. Write, experience, age, references.—Box 2020.

ELECTRICIAN/technical assistant to assist with and later take charge of development and production of industrial heat exchangers and assist works management. O.N.C. or H.N.C. or equal technical training an advantage. Commence at 6s. 3d. per hour. Please write stating age and experience. — Hupfield Plant Ltd., Willow Lane, Mitcham. 2045

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works. Inverness Road, Hounslow, Middx. 275

ENGINEER (Grad. I.E.E. std.) to assist in development and testing of power capacitors and of transformers up to 15 MVA. Post provides an ideal opportunity to gain experience in a diversity of electrical fields including use of a 1,500-kV Surge generator. Apply in writing in the first place to—Chief Engineer, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Wallington, Surrey. 2021

ESTIMATOR and planning engineer required for expanding company of electrical and mechanical manufacturing engineers. Good opportunity for man with some practical experience and knowledge of industrial electrical estimating. Good canteen facilities and staff pension scheme in operation.—Peppers of Woking Ltd., Stanhope Road, Camberley, Surrey. 2233

JUNIOR estimating and contracts engineer required for expanding switchgear company. Should have H.N.C. or equivalent. Progressive position for right man. Apply stating age, salary required and experience to date to—Reference AWB, Switchgear & Equipment Ltd., Southam Road, Banbury, Oxon. 2148

JUNIOR electrical draughtsman. Progress for keen young man. Please write stating age, experience and salary expected.—Hupfield Plant Ltd., Willow Lane, Mitcham. 2044

LADY tracer required by electrical contractor, Victoria (London). Interesting work; permanency. Write age, experience and salary required.—Box 2166.

LONDON consulting engineers require electrical engineers for installation design for hospitals, commercial buildings, schools, etc. Write stating age, qualifications, experience and salary required to—Box 160.

MAINTENANCE electrician for general industrial maintenance and breakdowns in London area. Good rates for experienced man. Write or call — E.I. Ltd., 65, Vincent Square, Westminster, S.W.1. 2149

OLD-established electrical contracting firm in the Midlands have vacancies for young ambitious men with good personality and some knowledge of the trade for training to fill senior executive positions. Good salary. First-class possibilities for right men.—Box 2196.

PICKERINGS Limited have vacancy with excellent prospects for sales manager at their London office. Apply in confidence to—Managing Director, Pickerings Lifts, Globe Elevator Works, Stockton-on-Tees. 2026

PROGRESSIVE job for young technical writer (25-35), qualified in electricity and electronics. Sound knowledge of TV - radio circuitry. Pleasing personality.—Box 2183.

REPRESENTATIVES required by electric lamp manufacturers. Vacancies in various parts of the country.—Box 2197.

SALES and service engineer required in London office of G.W.B. Furnaces Ltd. for Powermaster packaged boilers. Previous boiler experience unnecessary as full training will be given at company's works. Preference will be given to a man with sound electrical knowledge. Write in confidence to G.W.B. Furnaces Ltd., Sicilian House, Sicilian Avenue, London, W.C.1. 2184

SALES engineers. Johnson & Phillips invite applications from men with suitable experience for a position as technical sales engineer to sell cables, principally to industrial and trade purchasers, in the Manchester branch area. Applications giving details of qualifications, experience and salary grouping should be sent to—Sales Director, c/o Employment Department, Johnson & Phillips Ltd., Victoria Works, Charlton, London, S.E.7. 2223

SALES representatives required for North, Midlands and South of England areas for company manufacturing full range of electricity meter products. Applicants should have good administrative ability and personal contacts at all levels in this field of sales. Applicants should supply full details of experience, age and salary required. Sales commission, car allowance and superannuation scheme. Replies, which will be treated in the strictest confidence should be addressed to the General Sales Manager, Aron Electricity Meter Limited, 72-82 Salusbury Road, London, N.W.6. 1886

SENIOR and assistant draughtsmen, experienced, for lighting and power schemes for hospital, office and school buildings, also specifications. Annual bonus, five-day week and 3 weeks' holiday. Consulting engineers, Holborn (London) area.—Box 2086.

SENIOR electrical draughtsman required with experience in the field of general distribution and utilisation. Qualifications and experience should be to Higher National Standard or equivalent. A younger person with O.N.C. or equivalent could be considered for a junior electrical draughtsman post provided he has potential. The company operates a non-contributory pension and insurance plan. Apply by letter to the—Personnel Department, Kodak Ltd. (Factories), Harrow, Middlesex, quoting DGD/1. 2208

SWITCHGEAR manufacturing company requires young engineer to train with outside erection department on installation, testing and commissioning on site. Applicants, who should be of H.N.C. standard in electrical engineering, must have completed National Service, and be prepared to travel. Please give details of experience and qualifications, age, and salary required to—Box 2107.

SERVICE engineers required for company manufacturing full range of electricity meter products. Experience of electricity meters desirable but not essential. Applicants must have sound technical background and be prepared to travel throughout the British Isles. This position offers first-class opportunities for further advancement. Applicants should supply full details of experience, age and salary required. Car supplied and superannuation scheme. Replies, which will be treated in the strictest confidence, to be addressed to the General Sales Manager, Aron Electricity Meter Ltd., 72-82, Salusbury Road, London, N.W.6 1887

STORES and clerical assts. req'd. Knowledge of trade and equipment desirable. Good prospects. Pensionable.—L.E.C., Wholesalers, 92, Blackfriars Road, London, S.E.1. 2102

SWITCHGEAR sales engineer required for estimating and contracts work. Applicant must have experience of 11 kV switchgear. Previous sales experience desirable, not essential. Vacancy is at Amersham but applications for London would be considered. Five-day week, bonus and pension schemes. Apply in writing with full details stating salary required. —Sales Manager, J. G. Statter & Co. Ltd., 82, Victoria Street, London, S.W.1. 2224

TECHNICAL assistant for sales office engaged in tendering and executing contracts for transmission line insulation. Qualifications: Higher National Certificate preferable, and previous tendering experience and ability to handle correspondence would be considered an advantage. Replies stating age, qualifications and experience should be addressed to the Personnel Officer (Staff), Pilkington Brothers Limited, St. Helens, Lancashire. 2188

TELEPHONE plumber-jointers required by firm of cable manufacturers for service in this country and abroad.—Box 1979.

TEMPERATURE control panel designers required by The Rheostatic Company Ltd. of Slough. Applications invited from men or women who have experience in the layout and circuitry of electrical control systems and are capable of presenting such layouts in diagram form so that they may be clearly interpreted by production wiremen. O.N.C. in Electrical Engineering desirable. Apply to — Personnel Manager, Farnham Road, Slough. 2150

TESTER of automatic electric control equipment required. Interesting work with good prospects. O.N.C. standard preferred. Five-day week, pension scheme, canteen facilities. Please write giving full details of age, previous experience, qualifications, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 277

TESTING staff required for telephone cable contracts in various parts of the country. Apply by letter to—Telecommunications Department, Pirelli-General Cable Works Ltd., Eastleigh, Hants. 2047

THE TELEGRAPH CONSTRUCTION & MAINTENANCE Co. Ltd., require a technical sales representative to work from their London office. Applicants, preferably between 25 and 35 years of age, should have outside cable selling experience in London and the Home Counties. In addition, a knowledge of industrial plastics would be an advantage. Excellent conditions of employment. Please apply with full details to—Home Sales Manager, The Telegraph Construction & Maintenance Co., Ltd., Mercury House, Theobald's Road, London, W.C.1. 2234

TRANSFORMER designer/draughtsman, experienced with units up to 250 kVA. Salary commensurate with experience. Bonus and free housing accommodation to suitable applicant.—Stewart Transformers Ltd., 75, Kilburn Lane, London, W.10. 2225

TWO lighting sales representatives required for London area. Only salesmen experienced in selling to industrial and commercial users with proved sales records may apply. Salary and commission. Car provided or contribution made to car owners. Apply to—Secretary of Ensel Electric Co. Ltd., 3, Eden Grove, London, N.7 (Phone, North 5866). 2169

WORKS engineer required for modern engineering works in Newcastle/Durham area to take charge of servicing and maintenance of the up-to-date electrical installation carrying a load of approximately 1,500 kW. The plant includes La Mont high-pressure hot water heating boilers and modern high-precision metal turning and grinding machines used on mass production. Experience of A.C. and some D.C. essential. Reply stating age and full particulars of experience and salary required.—Box 2050.

YOUNG electrical engineer required for sales office of arc welding equipment manufacturers. Apply—Murex Welding Processes Limited, Waltham Cross, Herts. 2129

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

A.M.I.E.E. (1951), Englishman, U.K. trained, aged 34, with fourteen years' experience in India, in sales, service and factory management, seeks post in Commonwealth.—Box 9235.

AUTOMATIC telephone & telecommunications engineer, ex-R.N.V.R. W/Tel., seeks wider outlook.—Box 9238.

ELECTRICAL engineer, D.F.H., 25 years' experience, technical liaison, sales representation, lifts, hoists, cranes, motors, comm. motors, seeks change. London area preferred. —Box 9234.

ENGINEER, A.M.A.I.E.E. (38), experienced switchgear, control gear and electronics, sales and managerial, requires position London and Home Counties and/or S.W. England.—Box 9236.

ENTHUSIASTIC young man seeks post as manufacturers' representative or similar position in electrical industry. Home or abroad. Excellent references.—Box 9250.

EXPORT-sales manager, thoroughly experienced in radio, T.V., domestic appliances and heavy gear exports, aged 43, desires change. Fully qualified professional electrical and mechanical engineer. Languages: French, German, Spanish, Dutch. Willing to travel. Car owner. —Box 9240.

FOREMAN electrician/supervisor, age 33, requires appointment, preferably abroad; experienced contracting home and overseas.—Box 9248.

TWO electricians (supervisors) desire overseas contracts.—Box 9251.

ARTICLES FOR SALE

BRASS ROLLED THREAD SCREWS, NICKEL PLATED AND SELF COLOUR

CHEESE HEAD

438 gr. 8 B.A. × ¼ in. N.P.	per gross	1s. 3d.
584 gr. 6 B.A. × 5/16 in. S.C.	„	1s. 0d.
227 gr. 6 B.A. × ⅜ in. N.P.	„	1s. 0d.
278 gr. 4 B.A. × ½ in. N.P.	„	1s. 3d.
546 gr. 4 B.A. × ½ in. S.C.	„	1s. 3d.
563 gr. 4 B.A. × ½ in. S.C.	„	1s. 6d.

ROUND HEAD

484 gr. 6 B.A. × ¼ in. S.C.	per gross	11d.
169 gr. 4 B.A. × ½ in. N.P.	„	1s. 8d.
200 gr. 4 B.A. × ½ in. S.C.	„	1s. 8d.
237 gr. 2 B.A. × ½ in. S.C.	„	1s. 9d.

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236 gr. 8 B.A. × ¼ in. S.C.	per gross	1s. 0d.
403 gr. 6 B.A. × 3/16 in. S.C.	„	1s. 0d.
527 gr. 4 B.A. × ½ in. N.P.	„	1s. 0d.
441 gr. 4 B.A. × ½ in. S.C.	„	1s. 1d.
200 gr. 4 B.A. × ½ in. S.C.	„	1s. 4d.

The above prices are not applicable to orders less than £15 nett value.

Many other sizes available at similar terms.

Detailed list on request from:

D. C. WOODBERRY
Cardigan Road, Henleaze, Bristol

9243

Always specify and use the
PORTAWAY EARTH-CONTINUITY AND BONDING SYSTEM
for Electrical Safety.

Chosen for reliability and service by those who "know." Good delivery for export and home trade.

See Stand D.10, Electrical Engineers Exhibition, Earls Court, London, S.W.5. March 25th-29th. Season ticket on request.

New brochure, price list, from

PORTER ELECTRICAL PRODUCTS LTD.
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(Tel. 3853) 2151

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Squirrel Cage, Continuously Rated

H.p.	Make.	Speed.	Encl.	
25	CROMPARK.	960	S/P	£48
25	„ „	1450	S/P	£44
15	„ „	950	T/E	£38
10	„ „	1440	S/P	£24
25	BRUCE PEEBLES	1450	S/P	£44
4	„ „	1450	S/P	£18
5.5	L.D.C.	1450/470	S/P	£26
15	„	975	T/E	£38
15	„	720	S/P	£34
7.5	E.E.	950	T/E	£22
15	„	970	S/P	£30
5	„	955	S/P	£20
2	„	1440/72 (Geared Unit)	T/E	£28

Slipring, Half-hour Rated

12.5	L.S.E.	Speed 940	£24
15	„	„ 950	£28

All 400/440 volts, 3-phase, 50 cycles, overhauled and guaranteed.

ELECTRICAL EQUIPMENTS (CARDIFF) LTD.
Tresillian Engineering Works
Dumballs Road, Cardiff

2199

GENERATORS

100 Unused 30-kW, 225-volt D.C. Generators by MAWDSLEY, compound wound, 960 and 1,440 r.p.m., Class 2, continuously rated, cowl ventilated.
First-class condition.
Immediate delivery covered by guarantee.

Lightweight Alternators for Portable Generating Sets

100 Unused 4-kVA, 230-volt, single-phase, 100-cycle Alternators, 3,000 r.p.m., self-exciting with automatic voltage regulators.
Immediate delivery with guarantee.
Alternators only ..... Price £30
Alternators with A.V.R.s Price £45

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
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Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 1927

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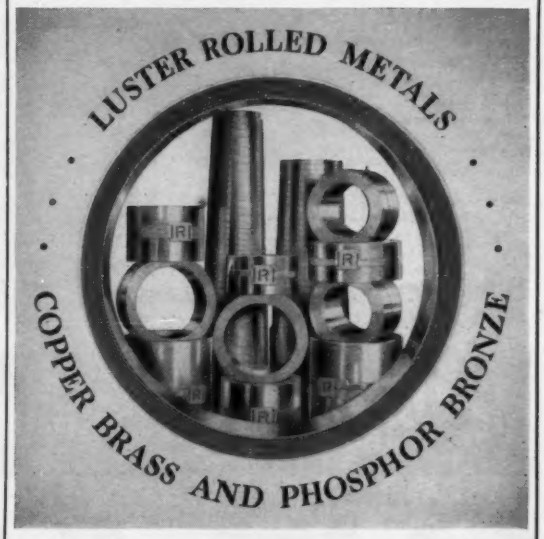

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Dorset House, Stamford Street, LONDON, S.E.1

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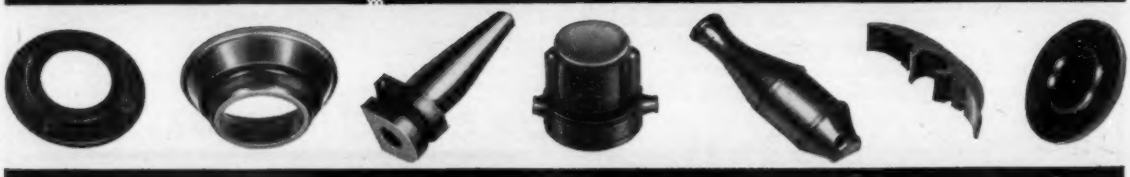

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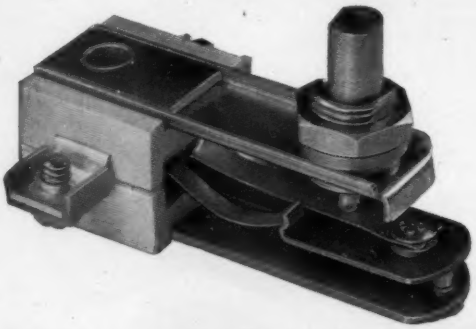

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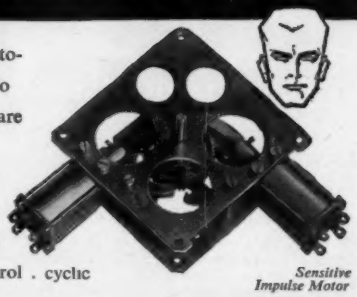

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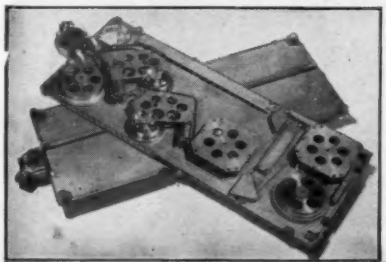

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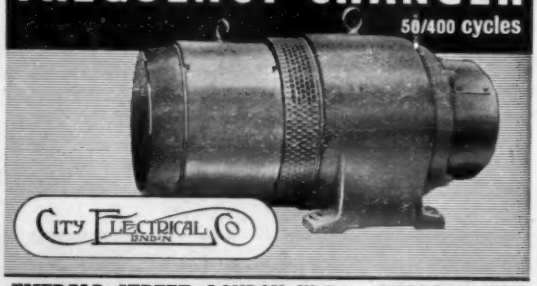

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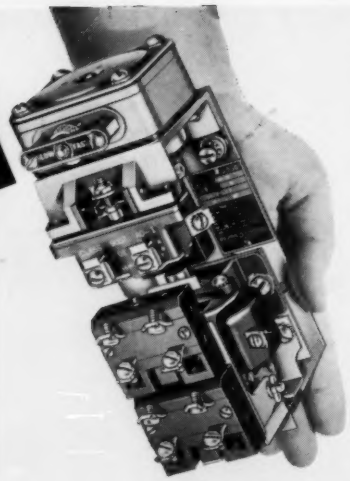
3 New timers



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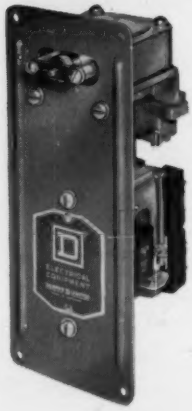

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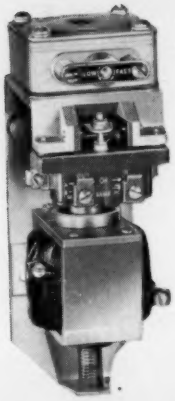

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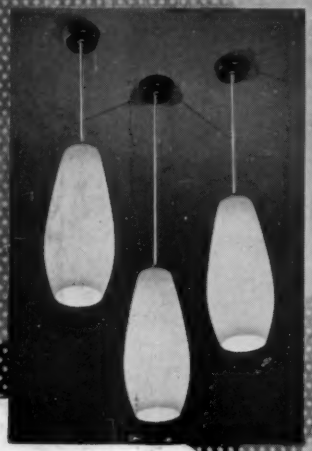

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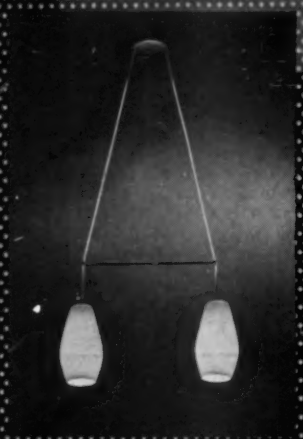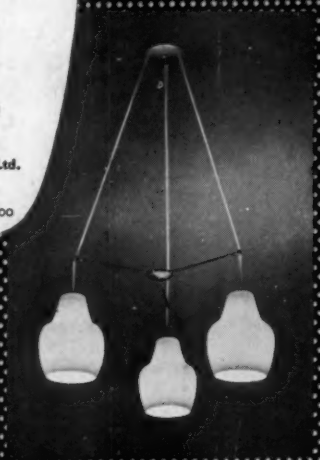
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